# PRIZE ESSAYS
ON
# PROCESSES IN WOOLEN, WORSTED, COTTON AND KNIT GOODS MANUFACTURING

PRICE, $1.50

strictly confidential.

## DEPARTMENT OF SKILLED TEXTILE LABOR

**( Overseers Bureau )**

The functions of our Mill Bureau are to find employment for the efficient workman who is out of work, to aid good men to obtain promotion, and to harmonize conditions within the mill gates.

To enable us to render the best Bureau service we require that every applicant for membership fill out blanks making his statement cover all the essentials of his experience.

On receipt of these forms properly filled out, and all the requirements met, we put the name of applicant on the active list and let him know of positions which his experience qualifies him to take.

In preparing these forms to meet our requirements we kept in view the convenience of applicants for registration. The items will remind him of the various processes, machines, methods, and materials used.

We consider it essential to best Bureau service that statements of experience, practical and technical, be very complete, that we have the names of people to whom we can write and verify all statements made, and obtain testimonials as to efficiency and character. Also it is of the greatest importance that we know where presently and previously employed, positions held, and time employed.

FRANK P. BENNETT & CO., INC.,
530 Atlantic Ave.,
Boston, Mass.

# Textile Processes

A

## COLLECTION OF ESSAYS

ON

# Processes in Woolen, Worsted and Cotton Manufacturing

From the American Wool and Cotton Reporter



PUBLISHED BY

FRANK P. BENNETT & CO., INC.

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# PRIZE ESSAYS ON TEXTILE PROCESSES

The essays printed in this volume were written in competition for one of the American Wool and Cotton Reporter's famous contests. A series of ten prizes of $25 each—or $250 in all—was offered, the first prize in each series being $10; the second, $6; the third, $5, and the fourth, $4. The attractiveness of the offer, however, was not so much in the money value, as in the eminent character of the judges by whom the contest was decided. The winners of these prizes were as follows:

WOOL CARDING.

First Prize, Essay No. 50, by George F. Maguire, Malone, N. Y.
Second Prize, Essay No. 18, by John S. Sherwood, Plainville, Conn.
Third Prize, Essay No. 93, by E. A. Jones, Burnesville, Ohio.
Fourth Prize, Essay No. 43, by A. B. Hanscom, Lowell, Mass.

WOOLEN SPINNING.

First Prize, Essay No. 56, by C. C. Harris, Killingly, Conn.
Second Prize, Essay No. 48, by Matthew Allan, Waterville, Me.
Third Prize, Essay No. 13, by John E. Gilroy, Hillsboro Bridge, N. H.
Fourth Prize, Essay No. 67, by Leonard W. Maine, Proctorsville, Vt.

WOOLEN AND WORSTED WEAVING.

First Prize, Essay No. 23, by George T. B. Jackson, Augusta, Ga.
Second Prize, Essay No. 39, by George Needham, Philadelphia, Pa.
Third Prize, Essay No. 58, by William F. Rawley, Stafford Springs, Conn.
Fourth Prize, Essay No. 84, by Norman Hirst, Providence, R. I.

WOOLEN AND WORSTED FINISHING.

First Prize, Essay No. 60, by L. G. Drummond, Winchester, Va.
Second Prize, Essay No. 42, by Joseph H. Ridings, Providence, R. I.
Third Prize, Essay No. 31, by Jas. A. Taylor, Martinsburg, W. Va.
Fourth Prize, Essay No. 17, by John L. Timmermann, Worcester, Mass.

## COTTON CARDING AND OTHER PREPARATORY PROCESSES.

First Prize, Essay No. 95, by William Shaw, Fall River, Mass.
Second Prize, Essay No. 55, by John J. Hogg, Philadelphia, Pa.
Third Prize, Essay No. 4, by F. G. Stephenson, Weldon, N. C.
Fourth Prize, Essay No. 98, by W. Smith, Brunswick, Me.

## COTTON SPINNING.

First Prize, Essay No. 29, by F. I. Hall, Augusta, Me.
Second Prize, Essay No. 100, by Rodger Graham, North Adams, Mass.
Third Prize, Essay No. 101, by J. C. Edwards, Rome, Ga.
Fourth Prize, Essay No. 33, by Sidney S. Salsbury, Allenton, R. I.

## WORSTED COMBING.

First Prize, Essay No. 91, by W. H. Cockcroft, Farnumsville, Mass.
Second Prize, Essay No. 5, by Thomas F. Johnson, Camden, N. J.
Third Prize, Essay No. 73, by A. W. Hadden, Philadelphia, Pa.
Fourth Prize, Essay No. 62, by H. Robinson, East Dedham, Mass.

## WORSTED SPINNING.

First Prize, Essay No. 46, by Joseph Harrison, Passaic, N. J.
Second Prize, Essay No. 1, by Henry Ingham, Ashtabula, Ohio.
Third Prize, Essay No. 83, by George J. Dunn, Philadelphia, Pa.
Fourth Prize, Essay No. 89, by Wm. S. Shaw, Fall River, Mass.

## PROCESSES OF KNITTING.

First Prize, Essay No. 71, by S. M. Peterson, Utica, N. Y.
Second Prize, Essay No. 69, by J. C. Lowrey, Wilmington, Del.
Third Prize, Essay No. 6, by Walter P. Brown, Philadelphia, Pa.
Fourth Prize, Essay No. 66, by Wm. N. McCard, Philadelphia, Pa.

## THE JUDGES.

The eminent and experienced manufacturers who kindly consented to act as judges in this contest were:

Charles H. Fish, General Manager of the Garner Print Works and Bleachery Co., Wappinger Falls, N. Y.

Louis B. Goodall, Treasurer, Goodall Worsted Co., Sanford, Me.

R. W. Eaton, Agent, Cabot Mfg. Co., Brunswick, Me.

Elmer E. Page, Agent, York Manufacturing Co., Saco, Me.

Carl Henniche, Aberfoyle Mfg. Co., Chester, Pa.

John Burt, President of the Southwark Mills Co., Philadelphia, Pa.

John Shirreffs, Treasurer, Shirreffs' Worsted Co., Fitchburg, Mass.

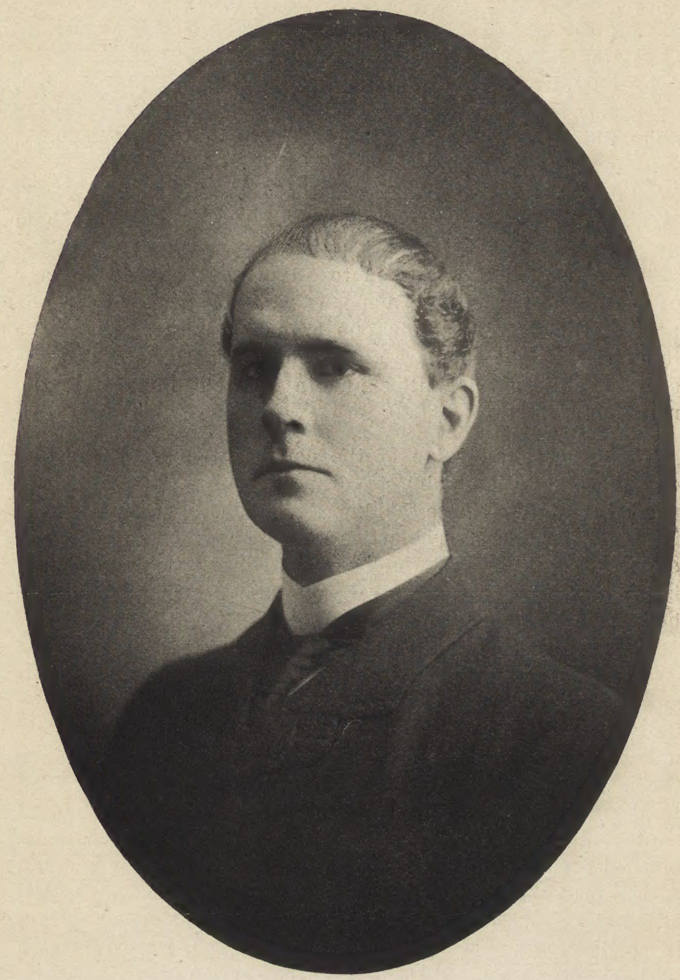
Walter Buck, Secretary, Fitwell Knitting Co., Cohoes, N. Y.

William C. Payne, of the William Carter Co., Needham Heights, Mass.

The competition was open to all persons engaged in any of the above pursuits as a means whereby overseers in one part of the country, or in one branch of any of the above industries, might compare and exchange methods with overseers in different localities and in different lines of textile manufacture.

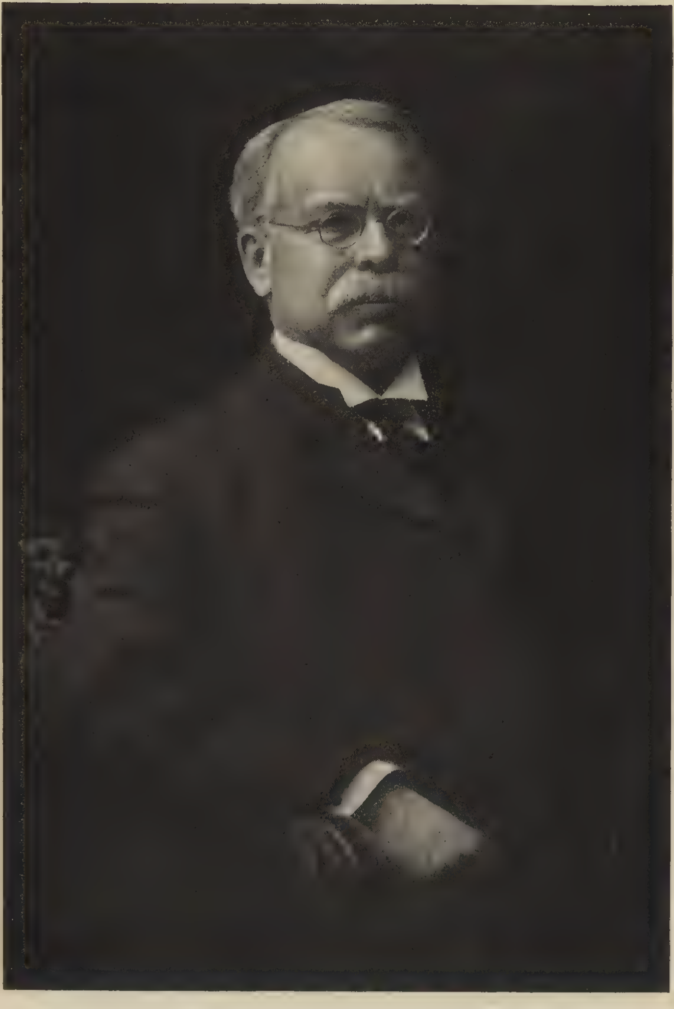
The educational value of the contest was great, the aim of the competition being to draw out facts known to one person and to distribute this knowledge among others engaged in similar branches. The articles covered nearly all processes of manufacture in the woolen, worsted, cotton and knitting industry, and the publication of the essays in book form will be valuable to manufacturer and operative alike.

In this competition the prizes were awarded solely on the merits of the articles submitted, irrespective of their authorship. The authors' names were not divulged until after the judges had rendered their decisions, and they were absolutely unknown to the judges themselves, who pronounced upon the merits of the articles submitted in competition according to the actual worth and value of the knowledge and ideas contained in them, regardless of rhetorical style or grammatical construction. The matter contained in these articles, rather than the form or manner in which it was stated, governed the awards of the prizes. Grammatical errors, errors in spelling, punctuation, etc., if any occurred, were corrected by our editor. Very little of such correction was necessary, however, and the matter is mentioned merely to emphasize the fact that the essays were judged solely upon their value as technical discussions.



CHARLES H. FISH.

**General Manager Garner Print Works and Bleachery Company, One of the Judges in the Contest.**



LOUIS B. GOODALL.

**Treasurer Goodall Worsted Company, One of the Judges in the Contest.**

## LOUIS B. GOODALL.

Treasurer, Goodall Worsted Company, One of the Judges in This Contest.

Louis B. Goodall was born in Winchester, N. H., September 23, 1851. He was the son of Thomas and Ruth (Waterhouse) Goodall.

Thomas Goodall, son of a woolen manufacturer, was born in Dewsbury, England, September 1, 1823, and came to the United States in 1846. Ruth Waterhouse, his mother, was born in Dudley, Mass., April 10, 1826. Her father, Jerry Waterhouse, also a woolen manufacturer, was born in England, December 18, 1778, and came to the United States in 1819. His ancestors were Flemish and went to England in the eleventh century to establish the manufacture of woolen cloth in that country.

### EARLY TRAINING.

Louis B. Goodall's education was begun in the common schools of Troy, N. H., where his father established the Troy Blanket Mills, and he continued one year in a private school in Thompson, Conn., 1862-3; then at the Vermont Episcopal Institute in Burlington, Vt., for three years, 1863-6; and in a private school in England, 1866-7. In 1870 he entered the Kimball Union Academy at Meriden, N. H., to prepare for Dartmouth College, but soon after was called home to take an active part in the Sanford Mills, Sanford, Me. His father established these mills in 1867 and Louis B. Goodall went to work in them as a common hand until 1870, to learn the business. In 1870 he was promoted to the office as bookkeeper and paymaster. In 1874 he established the Mousam River Mills in Sanford, acting as treasurer and superintendent. In 1881 he organized and started with his two brothers, under the style of Goodall Brothers, the mohair car and furniture plush business. In 1884 this was incorporated under the name of the Goodall Manufacturing Company, with Louis B. Goodall as treasurer. In 1885 the Goodall Manufacturing Company and Mousam River Mills were consolidated with the Sanford Mills, and all these concerns have since been carried on under the name of the Sanford Mills. In 1883 he was elected clerk and in 1885 a director of the Sanford Mills, which position he still holds.

### VARIED ENTERPRISES.

In 1889 he organized and started the Goodall Worsted

Company, acting as treasurer, with a capital of thirty thousand dollars, which is now one million dollars. In 1893 he was elected treasurer of the Mousam River Railroad Company. In 1896, the Sanford National Bank was established with Louis B. Goodall, president; its capital was $50,000. On January 1, 1910, its surplus was $100,000 and reserve $67,009.76, its deposits being $1,055,429.17. It is the Honor Bank of Maine.

In 1897 he was elected treasurer of the Sanford and Cape Porpoise Railway. In 1897 the Sanford Power Company was organized with Louis B. Goodall, treasurer. In 1899, he organized the Maine Alpaca Company, acting as treasurer. In 1903 he organized the Goodall Matting Company and acted as treasurer.

In 1904 he was appointed chairman of the Maine Commission to the Louisiana Purchase Exposition at St. Louis. In 1909 he received a commission of Lieutenant Colonel and was appointed on Governor Fernald's staff. (Maine). He is First Vice-President of American Association of Wool and Worsted Manufacturers. He was one of the organizers and directors of the Fidelity Trust Company, Portland, Me., and is a director in the Maine Insurance Company and treasurer of the Atlantic Shore Line Railway, an electric road owning 100 miles of track.

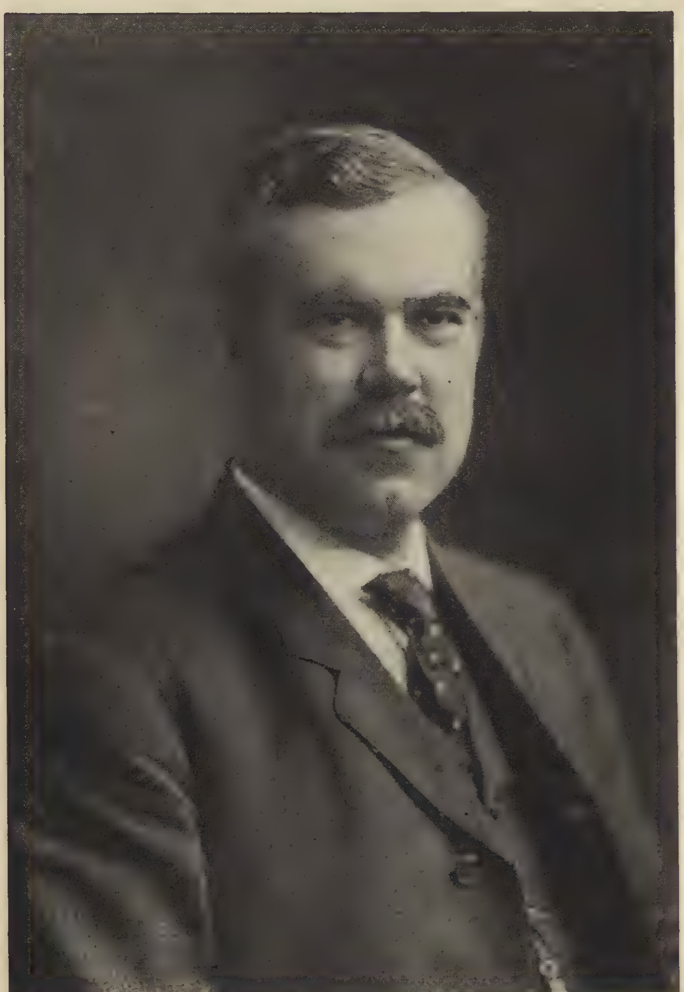
## CARL HENNICHE.

One of the Judges in the Prize Essay Contest.

Was born in Gera, Reuss, Saxony, September 10, 1866. He received his education at the public high school at Gera. He took a course at the textile school of the same place. He learned textile manufacturing with W. Theodor Gey, Gera, mainly in woolen and fine worsted dress goods. He enlarged his knowledge of weaving and finishing at several mills at Glauchan and Mesrane, Saxony.

In 1903 he came to New York and was for a short time with C. A. Auffmords & Company, New York City, and went in 1907 to the Aberfoyle Manufacturing Company, Cheever, with which concern he is still connected.

He took a course in the Philadelphia Textile School evening class, and was one of the founders and incorporators of the Alumni Association of the Philadelphia Textile School.



JOHN BURT.

President Southwark Mills, Philadelphia, Pa., One of the Judges in the Contest.

## WILLIAM C. PAYNE.

### One of the Judges on Processes of Knitting.

Is a native of Hinckley, Leicestershire, England, where his father and grandfather both had shops of hand knitting frames until the power frames rendered them unprofitable in the seventies. His earliest recollection is of going into his father's shop to watch the knitters, and before he was ten years old he used to wind yarn for them after coming out of school. At eleven years of age, in 1874, he entered the employ of William Crow (afterwards Crow & Truston), of that town as a winder and caster, and at fourteen years of age was apprenticed for four years to learn the flat rib knitting and striped knitting thoroughly. He continued with this firm until its dissolution in January, 1891, having charge of their rib knitting machinery and winders from 1886 to the close of his employment there.

In April, 1891, he arrived in America and entered the employ of William Carter at Needham Heights (then known as Highlandville) two days after his arrival, running their flat rib knitters for a number of years, and for the past eight years has been in charge of the fashion knitting department of that firm, now known as The William Carter Co., manufacturers of union suits, infants' shirts, vests, bands, leggins, mittens, gaiters, ladies' vests and drawers and knit-goods in general.

During the period between 1893 and 1900 he contributed articles on knitting subjects to the "Reporter" occasionally, but for the past few years has spent his spare time in writing for various Boston newspapers.

From the above it will be seen that he has a knowledge of knitting processes extending over thirty-five years and the length of his service with both firms will be sufficient evidence as to his capacity. In these days it is not very often that you will find knitters who have stayed with two firms for a period covering thirty-five years. On April 15th, next, he will complete nineteen years of service with the William Carter Company.

## TEXTILE NEWSPAPER CIRCULATIONS.

The value of advertising depends on the quality and quantity of circulation of the publication employed, and in the word quality we include the adaptability of the field which the publication covers for the purposes sought by the advertiser. There are advertising solicitors who argue that the personality of the canvasser is the most important element in securing business; but if such were the fact, the sale of gold bricks would be a popular industry, since that occupation demands no intrinsic value. But it will be the general conclusion that the final test of the value of advertising space, as of every other commodity, is intrinsic value.

The AMERICAN WOOL AND COTTON REPORTER is willing and anxious to submit to any test of the intrinsic value of its advertising, whether that test be the number of names of its subscribers, the amount of postage paid at the Post Office, the number of copies which come from the presses, or any other test in which competitors for business are included upon equal terms.

But after all this has been said, we return to our original claim that the real test of circulation, in a business field like the textile industry, lies in the amount of collections from paid subscriptions. We repeat that the value of newspaper advertising depends upon the quality and quantity of the circulation. Under the term quality may be included the extent to which the circulation covers the kind of buyers whom the advertiser desires to reach. Under this heading may also be included the fact that a single copy of the publication is eagerly read by many different persons; for example, a single copy of the AMERICAN WOOL AND COTTON REPORTER may be read by twenty, or even fifty, persons in a mill or selling house. This element, however, is subject to some limitations; as, for example, if the persons desire to see the paper each week at the earliest possible moment, then they will not wait until it becomes their turn to secure the single copy of the publication. Hence, the fact that a single copy is read by fifteen or twenty or one hundred persons may be interpreted both for and against the merits of the publication.

In respect to quantity, the real circulation is not determined

by the number of copies printed, for it might happen in exceptional instances that two-thirds of the edition was destroyed or thrown away or distributed free to persons who were not interested. If papers are distributed free to persons who are not interested in them, it is evident that such copies cannot be properly included in circulation within the full meaning of the term; on the other hand, if a person subscribes and pays for a paper it is evidence, at least in the majority of cases, that the paper is read, otherwise it would be discontinued. Hence, even Post Office receipts showing the number of pounds of matter mailed are not conclusive. Of course, there is sometimes a freshness of interest in free sample copies which may cause them to be read once by persons who would not be continually interested in the publication, but the fullest examination of this kind of newspaper circulation in every direction—and with the admission that the AMERICAN WOOL AND COTTON REPORTER is willing also to meet any other test which may be submitted to by alleged competitors brings us back to the conclusion that genuine circulation is to be measured only by the amount of collections from paid subscriptions.

The textile manufacturers of the United States who have regarded the AMERICAN WOOL AND COTTON REPORTER as their only organ for nearly a quarter of a century are being much annoyed by various fake publications in New York and elsewhere. In order to save them this annoyance, if possible, we made the following challenge several months ago, and it has thus far failed of acceptance, though various and many efforts have been made to explain it away.

As the quality of newspaper circulation depends largely upon paid subscriptions, we would give the sum of $500 if it could be proven that the cash collections from subscriptions by any other textile newspaper, either weekly or monthly, from mill presidents, treasurers, agents, superintendents and other officers of mill corporations for the twelve months ending July 31, 1909, were one-half those of the AMERICAN WOOL AND COTTON REPORTER.

This challenge is now continued for the twelve months ending December 31, 1909, and in so far as this warning refers to any textile newspaper in New York City, our announcement is that all of the above conditions will be complied with if such textile publication can show that its cash collections during the period specified were one-third

those of the AMERICAN WOOL AND COTTON REPORTER.

Moreover, this challenge is good against any other alleged textile newspaper which can show either:

1st. As above stated, that its total collections from mill presidents, treasurers, agents, superintendents, and other officers of mill corporations, for the twelve months ending December 31, 1909, were one-half those of the AMERICAN WOOL AND COTTON REPORTER, or in the case of an alleged textile newspaper published in New York City, one-third those of the AMERICAN WOOL AND COTTON REPORTER.

2nd. That its total collections for subscriptions of overseers and second-hands for the twelve months ending December 31, 1909, were one-half those of the AMERICAN WOOL AND COTTON REPORTER, or in the case of an alleged textile newspaper published in New York City, one-third those of the AMERICAN WOOL AND COTTON REPORTER.

3rd. That its collections from all sources, including presidents, treasurers and other executive officers; overseers, second-hands and other responsible employees inside the mill; salesmen, wholesale clothiers, shippers of wool and cotton, and all other sources, for the twelve months ending December 31, 1909, were one-half those of the AMERICAN WOOL AND COTTON REPORTER or one-third those of the AMERICAN WOOL AND COTTON REPORTER in the case of any alleged textile newspaper published in New York City.

The conditions of this offer are that the journals complying with this test on both sides shall submit their books to a chartered public accountant, that the inferior party on either side shall forfeit the sum of $500, and that the money shall be divided as follows: $250 for such form of prize as may be selected by the National Cotton Manufacturers' Association, and $250 for such form of prize as may be selected by the American Association of Woolen and Worsted Manufacturers.

The usual effort to evade this challenge by the advertising solicitors of various fake publications of little if any circulation, was to assert that our large collections from paid subscribers during the twelve months ending July 31, 1909, were due to unusual activity in collecting old bills. We

have now renewed the challenge for the twelve months ending December 31, 1909, and are perfectly willing to prove that our increase of new unpaid subscribers in 1909 was greater than the number and monetary value of the old subscribers collected; that is, while our collections were double those of any alleged competitor, our uncollected subscription bills from new subscribers also increased in amount during the same period.

It is easy to make large statements about newspaper circulation, and many advertising solicitors are willing to do so, but the test which we propose is absolute and unescapable. Another evasion of our challenge is accompanied by the statement that, while our alleged competitor may not have half the paid circulation of the AMERICAN WOOL AND COTTON REPORTER, yet that we are more than matched by its distribution of free copies. In answer to this we are willing to make a similar challenge in respect to the number of copies sent out last year on paid orders, or as samples to secure circulation. Where the AMERICAN WOOL AND COTTON REPORTER was sent out on paid orders in large number, as was done by many textile manufacturers and others, we have not included the money paid therefor in our subscription collections.

We have no special desire to either press or withdraw the above offers to test circulation, but they are open until further notice, and we hope will free the textile manufacturers of the United States from further annoyance.

FRANK P. BENNETT & CO., Inc.

**THE textile industry has become the King of all Industries and the true barometer of the trade of the world. To properly educate those advertisers who desire to secure participation in the rich purchasing power of this great textile industry, the AMERICAN WOOL AND COTTON REPORTER has been publishing the above challenge so generally that it must finally meet the eye of every advertiser.**

# INDEX TO ESSAYS

## COTTON CARDING AND OTHER PREPARATORY PROCESSES.



## WOOL CARDING.



## WOOL SPINNING.

## WOOLEN AND WORSTED WEAVING.



## WOOLEN AND WORSTED FINISHING.

## COTTON SPINNING.



## WORSTED COMBING.



## WORSTED SPINNING.



## PROCESSES OF KNITTING.



## MISCELLANEOUS.

# THE MANUFACTURE OF WORSTED YARN.

## ESSAY NO. 1.

After the wool has been sorted, the first process to consider is the scouring. On account of the difference in the hardness of the water in different localities, no hard and fast rule can be established as to the proper amount of soap and potash that should be used to scour any given amount of wool. The temperature of the scouring liquor should be about 120 degrees. Sufficient potash should be added to the water to soften it; then add sufficient soap to scour the wool. It is essential that the grease or gum in the wool should be cut before the wool goes through the first pair of squeezing rollers, because, if the grease is not cut, the squeezing rollers will not take it as they should do, and in the case of very fine, short stock, such as a fine delaine, they will not take it out at all, the rollers having a crushing, grinding effect on the stock, increasing its noilage, and injuring its spinning qualities. The importance of good wool scouring and clean wool cannot be too strongly emphasized. It means good carding, a low percentage of noil and good yarn, other things being as they should be.

In the wool scouring I favor the use of a neutral olive soap, and add the potash required, according to the condition of the water. A little ammonia is found to be useful in cutting the grease.

Scouring compounds are generally good to fight shy of, as they are usually too severe in their action, destroying the spinning quality of the fibre.

Clean wool is very self-assertive, and if it is clean, you do not handle it and wonder if it will do; you know at once that it is clean.

The next process is the drying, and leaving the wool in nice condition for carding. The lower the quality of the stock, the drier it ought to be. Low, long, coarse stock ought to be nearly bone dry, while a fine half blood or a delaine may be taken directly from the scouring machine to the card without drying, providing the squeezing rollers are in good condition. It is of the highest importance that the rollers of the card should be true. The usual method of turning up is to attach

a turning rest to the card and use a turning tool. Now, while that method is satisfactory when a good man is doing the job, there are few carders or machinists who have had the necessary experience to do such a job.

A better method, in my estimation, is to sew a strip of new filleting tightly around the grinding pulley, and set it to the cylinder and doffer as in grinding, employing the same method for the workers and strippers in the grinding machine.

When the rollers have been turned up, make a pencil mark about three-eighths of an inch from each edge of the roller, and keep your wire-edge to it when clothing. I have seen a good many rollers clothed with the wire actually overlapping the edges. It is slovenly and unworkmanlike, besides causing more fly and waste.

The clothing must be put on as tight as it is possible to get it; then grind up lightly, and set your card with the object in view of getting your stock through without chewing it up.

Give the workers a little room, that is, do not set them any closer than you have to. Set the strippers and doffers pretty fine, and get as much speed on your doffers as the nature of the stock will allow.

The theory of worsted carding is that the stock shall not go twice around the cylinder, and that when the feed rolls stop, the card shall immediately run clear. The proper speed at which a card ought to run should vary according to the stock. For instance, a card ought to run at 85 per minute for one-quarter blood or three-eighths blood, but it would not be advisable to run at more than 70 or 75 for low carpet stock.

It is a mistake to have a fancy any larger than 12 inches in diameter, as a larger fancy runs too heavy and loses speed, the belt is more apt to slip and, owing to the larger arc, in contact with the cylinder, it does not raise the stock as it should do, but on the contrary it is likely to beat the stock in the cylinder.

After carding, the card balls go to be backwashed, though many mills dispense with this operation, which consists in passing the sliver through two bowls of suds and through two pairs of squeezing rollers, then over five or seven steam-heated cylinders, then through a gill box. In this operation an automatic oiler drops olive oil or an emulsion of olive oil and soap on to the wool as it passes through, to put it in a condition for combing and spinning.

The gill box is a machine for drafting and equalizing the

sliver. It consists of a pair of delivering rollers and a pair of drawing-off rollers. The wool passes through the back rollers and through a set of fallers, and is then drawn off by the front rollers. If the front rollers draw off six yards where the back rollers deliver one yard in, it is called a draft of six. By altering the speed of the front roller we alter the draft. In case the backwashing operation is dispensed with, the olive oil is put on in the first gilling operation.

The wool is gilled twice, and sometimes three times, to equalize it and lay the fibres parallel, and to get the sliver the proper weight for combing.

The first principle in gilling or drafting is that in each operation the wool shall be drafted or drawn in the reverse direction to the previous operation. Consequently, after the card balls have been once gilled, and if the wool has been run on in the form of a ball, the balls should be put in a creel and run from the outside. If the wool has been run into a can, of course it is reversed.

The combing operation consists in extracting the shorts, or noils, straightening the fibres and laying them all parallel, one with the other. The circles are heated with steam, the object being to draw the fibres more easily through the pins, and the effect of the heat is to keep the fibre straight; on the same principle that a young lady will heat her curling tongs, to keep her hair in curl, so we heat the circles to keep the fibres straight and free from kinks. The question of the percentage of noil is open to much discussion, and I will try to give a few reasons, pro and con.

If a comber has been having a run on a certain lot of wool and there has been no alteration made in the wool room and he has been averaging, say, 9 per cent. noil right along, and the noil suddenly jumps up to 11 and 12 per cent., the management naturally wish to know the reason; the comber will probably say, "poor carding," and it may look like it. But the chances are that there has been some dirty wool washing. Dirty wool is the chief cause of excessive noil.

The percentage of noil will increase if the stock is combed too dry.

If the wool is dabbed down too deeply in the circles, the fibres will break more or less, thereby making more noil.

If the comber allows his help to run broken sets, instead of leveling up, and putting full sets in, he will make more noils because a full ball pulls back and he has to set his noil for the

full balls, allowing the half balls and bits to throw too far over the circle; and on account of the uneven delivery he is also liable to have a few hard twisted ends, which will not draw out in the subsequent gilling.

If the noil is found to contain too much long stock, it is probably because the star wheel or stroker is set too close to circle, and at the same time it is throwing too high.

The comb made with the S bar makes less noil than the straight bar, because the S bar allows the small drawing-off rollers to get a closer nip, thereby drawing off more stock.

On two combs that I tested with the same circles and the same stock the S bar comb noiled 8.5 per cent. and the straight bar 10 per cent.

If the fancy on the card does not work properly, so that the doffer cannot clear the cylinder, there will be more noil.

Any roller on the card that carries more wool than it ought is a noil maker. The operation of wool combing consists in dabbing wool into circles at the nearest point, and by the revolution of the circles the wool is parted, and the clear beard is drawn off by means of rollers, leaving the shorts or noil in the small circles.

The noil is then raised out of the small circles by means of knives or plows, and it then drops on the floor.

The draft of the comb is a matter of importance. It is obvious that the comb should have a longer draft on for long wool than for short wool. The draft may be altered by the speed of the circles, or by the drawing-off rollers, according to the judgment of the overseer. The alteration of the draft is neglected very often where it ought to be attended to. The combed top is then gilled twice, and is made up in the form of a top, each top having the same number of yards (the machine being stopped with a regular knocker-off), and each top is made to weigh approximately alike.

The tops then go to the drawing room. The drawing operation consists in drawing down, and equalizing the wool, and making it into a roving of the proper weight to spin to whatever counts are required. When the drawer gets a lot of wool to put through, to make, say, a 3.5 dram roving to spin to 36s, he will first examine his stock, measure the length of staple, and determine what draft it will stand. Suppose it is three-eighths blood and measures seven inches and he determines to put it through with about six of a draft, and he has seven operations. He will figure it up in this way:

Make 40 yards weigh 160 drams at first box, and weigh up his cans accordingly.

Operations, 2d, 3d, 4th, 5th, 6th, 7th. Weight in drams at each operation, 106.6, 106.6, 71, 35.5, 11.3, 3.5. Number of ends at each machine, 4x6x4x3x2x2 divided by 6x6x6x6x6 1-4x6.5 draft. Thus bringing out his roving to weigh 3.5 drams at the seventh operation.

The draft may vary a tooth or two from these figures, but it will be pretty close. The fourth operation is generally the weigh box, and a gear is put on the knocker-off that will just nicely fill the bobbin, and if it knocks off at six pounds, the sets are made up to six pounds for the next machine, each bobbin having the same number of yards wound on it.

For instance, if one bobbin weighs six pounds, and another weighs five pounds 13 ounces, and another one six pounds three ounces, they will go together for one set, and average six pounds each. If they begin to get a little lighter or heavier, the draft gear is altered at this operation to correct any variation. The purpose of the carriers is to retain the twist in the ends while the wool is being drafted, otherwise the stock would slip and be uneven. The twist is a matter of judgment in the drawing. The fallers in the gill boxes should be kept in first-class shape, so that they will penetrate the stock easily, and allow the wool to feel easy in the fallers.

If the back rollers go too slowly and keep the wool too deep and tight in the fallers, it is likely to make an uneven end, besides being hard on the machine.

The Bradford system of spinning is not a true spinning process. It is simply a continuation of the drawing process.

A 3.5 dram roving means that 40 yards weight 3 1-2 drams.

It is required to spin it to 36s and we wish to know what draft is required.

The formula is this:

As the gauge point (18.3) is to the weight of the roving (3.5 drams) so are the proposed counts to the draft required.

Example: As 18.3 :: 3.5 : 36

```
                  36
                  —
                 210
                105
                ———
        18.3)1260(7    Draft required
                1281
```

The length of the staple is then measured and the ratch or back roller is set accordingly. We now proceed to find out what gear is required to give a draft of 7.

For a frame geared up as follows: Front roller, 4 inches diameter; back roller, 1 1-4 inches diameter; back roller wheel, 100; double stud, 100x83; draft gear, 40:

$$\frac{\cancel{16}\times 83\times \overset{1}{\cancel{40}}}{4\times \underset{\underset{2}{\cancel{50}}}{\cancel{100}}\times 100}=\frac{83}{800}=9.6 \text{ Draft}$$

Then if 40 give 9.6, what will give 7?

As 7 is to 9.6, so is 40 to 55, gear required. The twist varies somewhat according to the quality of the stock, but in this case we will put in 14 turns per inch.

For a frame geared as follows: Front roller, 12.6 inches in circumference; cylinder, 10 inches in diameter; wharle, three-quarters of an inch in diameter; driving pulley, 8 inches diameter; driven pulley, 18 inches diameter; front roller gear, 268; wist gear, 64, the twist will figure out as follows:

$$\frac{\overset{4.2}{\cancel{12.6}}\times\cancel{10}\times\overset{4}{\cancel{8}}\times\overset{8}{\cancel{64}}}{\underset{5}{\cancel{75}}\times\underset{\underset{3}{\cancel{24}}}{\cancel{18}}\times\underset{67}{\cancel{268}}}=\frac{33.6}{33.5}=10 \text{ Turns}$$

Therefore 64 gives 10 and we want 14 turns.

```
14)640(45 or 46 gear
    56
    —
     80
     70
```

All calculations for draft, twist, knocker-off, etc., are worked out on the same principle. A larger draft gear will give less draft, and a larger back roller gear would give more. Simply divide one set of factors by the other.

The gauge point 18.3 in the calculations for the draft is the gauge point for 40 yards of roving, worked out as follows:

256 drams equals 1 pound.
560 yards equals 1 hank.
Therefore 40)560(14. Then 14)256(18.3 Gauge Point.

```
40          14
—           —
160         116
160         112
—           —
             40
             42
```

The number of turns of twist per inch depends a good deal on the spinning quality of the stock, as the better the quality the fewer turns are necessary. The more turns of twist we have to put in, the less the production; as the speed of the spindles is a fixture, we have to speed up the delivery rollers, or slow them down to alter the twist, thereby affecting the production. It does not pay to spin too close, or to go to the extreme limit of what the stock will spin to.

In measuring the length of the staple and setting the ratch or back roller, while it is permissible to break one or two of the longest fibres, I do not advocate it. It is better to give the stock its full length; if it is nipped at all, it makes a wild, hairy yarn. The method of finding the count of two different sizes of yarn twisted together is as follows: Multiply the two counts, then add them together and divide one by the other.

Example: What is the combined count of 20s and 36s twisted together?

```
    36
    20
    ——
56)720(12.85 Counts
    56
    —
    160
    112
    ——
     480
     448
     ——
      32
```

There are several causes for uneven, twitty yarn. The stock may be spun finer than it ought to go, or it may require a little more twist, or the ratch is too far back or uneven

rovings, or there may be bad top rollers, or excessive draft. A pretty safe rule for drafting is to have your draft correspond to the length of your staple in the spinning. Thus, if your stock measures seven inches, have a draft of seven, or maybe a trifle over. In some cases it may be desirable to have a longer draft, but the above is a safe rule.

I have seen some rather elaborate calculations made to find out the equivalent worsted counts for cotton and woolen.

There are 560 yards in one hank of worsted; there are 840 yards in one hank of cotton; there are 1,600 yards in one hank of woolen. Therefore 560 is to 840 as 2 is to 3, which makes 24s cotton, 36s worsted (add one-third); 560 to 1,600 is as 7 is to 20, therefore, 7-run yarn is 20s worsted.

What worsted counts is 5-run woolen yarn?

As 7 is to 20 so is 5 to 14 2-7 (worsted counts).

There are several forms of twisters on the market, but my preference for worsted twisting is a cap trap.

The calculations for finding the turns of twist are on the same principle as in the spinning; the doll rollers are driven by a double-cut worm, which counts as a 2-toothed gear. The rest is about the same.

One side of twisting is calculated to take two sides of spinning, and the usual way is to let one doffing from the spinning go to one side of twisting, so the bobbins will run out together, saving time and waste. If they are thrown into a box, and the girls help themselves, the sets get broken up, as the frames do not all doff alike.

## WOOLEN AND WORSTED WEAVING.

### ESSAY NO. 2.

I will consider both woolen and worsted weaving under one head, as the act of weaving the different kinds of yarns into cloth is the same in both cases with the exception of a few alterations in the setting of parts of the loom. This article is not intended to explain the art of weaving to the uninitiated, but rather to set forth a few ideas as the subject presents itself to me. We have to-day a wonderful machine for the process of weaving, not alone in complicated appliances whose operations seem almost impossible of accomplishment except with

human hands, but also in strength, simplicity and positiveness. After the first of our box motion looms were put on the market, within the last twenty-five years, there has been no radical change in the looms, except in the matter of strength and speed; the working parts are arranged in a little different manner to get more positive results. On the market to-day we have three makes of looms to choose from, practically at present only two, as the loom put on the market lately in Worcester is the same as the Knowles loom, with a few changes in the reverse motion, enabling the weaver to get back to the break caused by a defect in the yarn.

The looms which are in use to-day are of two types, made by the same concern, an open shed and a closed shed. At present, this is the radical difference between makes of looms—the closed and open shed. I do not dare to state which is the better loom, for on certain grades of work one loom will do better than the other, and vice versa. But for general expense in running, for repairs, etc., I believe that the Knowles is the loom. To handle worsted weaving properly, considering the expense of repair, production, etc., will require a heavier and more solid loom, about 74-inch reed space, and geared 2 and 1, and a Knowles loom; woolen goods, men's wear, a 92-inch reed space, equal gears; for ladies' dress goods a lighter intermediate loom with 92-inch reed space and equal gears. In men's wear there is a grade of goods which to-day we are compelled to weave on what is called a narrow loom and run at a very high rate of speed, one weaver running two looms. Fancies are made to some extent on these narrow looms, in the cheaper fabrics, as a narrow loom will handle tender yarn far better than the broader ones. I would like to state just here my opinion in regard to the type of looms to be used. For worsted weaving I favor a Knowles loom. In woolen weaving, especially where there is such an uncertainty of good strong yarn, I think a Crompton loom is preferable. I believe that the production will show up better in the finishing room from the above looms.

We now come to the weaving. First I will consider the matter of preparation for the loom. See that the warps are dressed properly and laid out in width correctly; if a warp is laid too wide on the beam, on certain grades of goods, it will be impossible for any finisher to match the sides and middle of his goods to a nicety. This is a defect not recognized by many. Look out for the listings. See that they are kept straight. A

great source of trouble is poor listings. There is no need of loose ends and sections, and a man is shown how, if he does not know, which means only a little care and judgment on the dressers' part. The drawer-in takes the warp next. Instruct this person about the different grades of goods; impress upon her the need of carefulness and thoroughness on her part, —overlooked later, can do lots of damage. The only way to make a success is to start right here; have a system; have it right throughout your room, with not too much red tape and complication. Avoid all confusion of signs or ideas in the different books or guides. It is a necessity to have a drawer-in book, chain-draft, and filling-draft book, besides your own. After the warp is ready and the loom properly cleaned, the fixers take it and get it ready to start, after which the filling carrier consults the warp ticket, previously made out, and brings the proper filling. The overseer now takes the work in hand, starts every warp and gives it a general inspection. See that the warp is hung correctly, that the colors and pattern are correct. Start the weaver and give it a final inspection after the leader is taken off. Now is the proper time to see how the loom is handling the work. I don't care how good your loom fixers are, they are apt to hurry or be pushed just at this time, and may have neglected to have things in the proper shape.

Production is to be considered just here. The highest compliment I ever heard paid to an overseer was this: "Why, you can go on any loom and you do not have to get used to it." Have them say this about your room. Get a good even pick; keep your sweep straps level. One can tell the condition of a weave room in a very few minutes after entering it, whether the looms are old or new. If a man can't make old looms run, it will only take him a few years to wreck new ones. Let me say here, that if a man cannot get a good, smooth pick on his looms (himself), he will never make a success of having charge of weaving. Production depends on this. Instruct your fixers that the looms must run, and keep the shuttles out of the windows, trying to find a resting-place up against the wall. It is generally unnecessary to have a loom continually banging off and mending in breakouts. There is no need of so-called bad looms in a shop. You often hear—Well, that man or woman can't weave; always running after the fixer. When you have one of these, get the loom fixed and the little things attended to so that they can't have any fault to find. Look

out for the little things; the big things are generally fixed, and the former left to cause lots of trouble.

Be on the alert; don't be afraid of a little work yourself; you are supposed to be just as wide-awake as the weaver and not sitting down in an easy chair trying so hard to keep awake. If you want production, you must hustle yourself. Don't use profane language because of carelessness and indifference on the part of the help; one or two cases of discharging will accomplish much where talk will do nothing. It is the overseer's place to see that the looms are in good running order and kept there, as much as it is to arrange his other work. Keep continually in the minds of all that it is production that counts. How many times we have seen a fixer sitting down, when a weaver comes along with a timid air, saying that something is wrong; the fixer scowls and mutters something, perhaps at times more than a mutter. After five or ten minutes he condescends to go and see what is the matter; with a rush and a mind distorted with anger he proceeds and with a hasty knock with the hammer or a tightened bolt the job is done and the handle pulled on; lo, and behold, the shuttles have come together, causing a large breakout or perhaps a broken casting, caused by nothing else than anger. The overseer is subject at all times to a display of temper, but the successful overseer is the man that controls himself—if he can't control himself, how can he control others? The happy condition of a weave room is the complete trust in the man in charge; this is brought about by careful study and thought, he having no favorites, thereby using all alike and fairly. Do not allow yourself to sympathize with the help in case of bad work and yield to them when they say that such and such stock ought to be put in; they know nothing of the condition of the markets and the close margins at times.

I will not give rules and methods of fixing, as it is an inexhaustible subject. See that the looms are set and running rightly, the weaving even and the cloth smooth. Look out for kinks, thread floats, filling, pulling in and roweyness. These all can be stopped easily by a careful looking after. What is needed is always to be on the watch. A man that gets the production with quality is the one wanted.

Have your reports readable and neat. Keep a record of things for yourself, which will enable you to look back and compare with this day or week. Know exactly what yarns you

have got, where they are, and the quantity, etc.; a system will make this easy.

Waste is quite an item in a weave room, and causes quite a lot of trouble. If there is an extra amount coming, first see where the blame lies. Usually it is the weaver who is at fault, but many times the trouble is elsewhere; it may be improperly started at the bottom, by the spinner, by the help lying on yarn in boxes and by loose winding by the spinner. See that these are stopped. There may be too much power on the loom, causing the filling to knock off the bobbin as it enters the shuttle boxes. Here is a chance to put in a good word regarding power. Have as little power on the shuttle as possible. Run your loom with the least possible amount. All extra power means money going out of the company all the time, and more or less imperfect work. Have the weavers trained to keep their flying waste and hard end waste separate at cleaning-up time.

The repair department is quite an item and waste can go on here. See that castings are not ordered needlessly, and when ordered are right; at times a patch is as good as a new casting. Instill into the fixer's mind the need of saving in the supplies for the looms. Some look at the stock on hand, caring nothing for the cost, and only make a halt when the stock is getting low. Shuttle checks are a grand good thing, and a mill that is not using them is losing by it; they are a sure money-saver. A saving in waste is claimed by the maker, but I claim more —that there is a saving in the general wear of the whole picking motion of the loom. Let me emphasize right here that the principal point in weaving is a smooth, even pick on your looms; get this and you will not have so very much trouble with your looms; there will be no need of being troubled with the different matters which we often see discussed in numerous papers concerning the loom. See that your belts are in good shape. I find that olive oil is better than all patent preparations, and keeps the belts in good shape. A great source of trouble is found in long lengths of shafting, what is called in the mill "back lash"; it is the vibration in the shaft, and if it is there, no man can make the loom run rightly. Stop it by either putting on balance wheels or belting to main shaft if possible.

The rate of speed of a loom is a question; high speed figures look well on paper and sound well in conversation, but the run of work has to be taken into consideration. Worsteds can be

run advantageously with a higher speed than woolens; plain work can be run with a higher speed than fancies. I don't think it practical to run a fancy worsted loom over 105 picks per minute and fancy woolens more than about 95; but this may vary according to the condition of the yarns. One thing more I would like to add: Bad work cannot be made to run good, but good work can be made to run bad in a weave room.

## COTTON CARDS AND CARDING.

### ESSAY NO. 3.

Card setting varies with the amount of cotton carded, the condition of the card and with the quality of the work required.

Some goods require cleaner carding with more short staple taken out than others. For example, the good man would set closer and card lighter for print goods than for the heavier ducks, drills or sheetings. On the former, all leaf and other impurities have to be removed to make a marketable piece of goods, while the latter will stand more leaf and also more short staple because of the coarser yarn spun.

For a card in a condition with clothing tight, evenly ground, and licker-in, cylinder and doffer paralleled, carding around 150 pounds in 11 hours from about a 12-ounce lap, the following settings will be found to give good results:

Feed plates to lick-in, .012 degrees; licker-in to cylinder, .010 degrees; cylinder to flats, .010 degrees; licker-in knives to licker-in, .012 degrees; cylinder screen to cylinder, .022 degrees; cylinder to doffer, .007 degrees, and front knife plate to take out from 2 1-2 to 3 pounds per day.

For coarser work set the feed plate form .017 degrees to .022 degrees, according to the weight of lap, and the licker-in knives the same.

Flats can be set to about .012 degrees, but doffer to cylinder should be .007 degrees for good work. Other writers may differ as to distances the different parts of cards should be set.

Different results may require slight changes in settings, but

no matter what settings be used, all cards on the same work should be set alike.

The above settings are for cards in good condition. If the fillets be loose or the cylinder out of line or flats ground hollow, the settings will be too close and face the wires.

A cylinder that runs against the arch shows the card either to be out of level or cylinder bearings of different height from the frame.

Wear of bearings can be helped by releveling cards before each grinding.

Cards should be lightly ground even every 20 days. If the wire be not faced or mashed, from four to six hours will be long enough. Before grinding, all cotton accumulated between the arches and the cylinder and doffer should be picked out and all fly removed to lessen the danger of fire. After grinding the flats, licker-in and doffer should be set. And in every three or four grindings screens should be taken out and the accumulations of oil and dirt taken out, which will produce a great change in your carding.

# IMPERFECT CARDING.

### ESSAY NO. 4.

In their efforts to get a larger production many mill managers adopt methods that practically defeat the object which they are supposed to accomplish. The most harmful and common error is to overload the pickers and cards by running more cotton through in a day than the machines can properly clean.

If the gross impurities be not removed during picking, the cards will to an extent be compelled to perform the functions of the picking process. As a result of this the clothing becomes quickly choked, and the principal object of carding is not attained. Carding is practiced for the purpose of laying the fibres in as nearly a parallel order as possible, and at the same time removing imperfect fibres, neps, bits of leaves and broken shells of seeds. The teeth of the clothing scrape along the fibres and accomplish this when the cards are not overloaded and when the laps from the pickers do

not contain impurities that should have been removed during picking.

When unclean laps are fed to the cards and at the same time the card is overloaded, the total production may be at such a figure as to please the manager, but when this mass of imperfectly cleaned cotton goes to the spinners, spoolers, warpers and weavers, the ratio of production is not maintained. The reason is clear to those who have seen more than one method of getting production employed.

In many cases the evils are unclean cotton going through the cards, not to mention the almost utter failure of parallelization of the fibres. This is increased by the formation of neps, that would not exist if it were not for the overloading.

Neps are small bunches of fibres rolled into knots, and wherever they are found in a thread of yarn, there will be found a weak point, as while the neps add bulk to the yarn, they detract from its strength by preventing the long fibres from properly twisting together, so that the full strength of the fibres cannot be utilized to keep off a strain that under ordinary conditions would not serve to break the yarn.

When the cards are overloaded, some of the fibres that otherwise would be cleaned and straightened are or will become matted and form neps. If the card grinder sets the grinders for heavy grinding, the result is the same as if the cotton were unclean and the cards not looked after. Heavy grinding gives the wire hooked points and the cylinder will soon be found filled up with fibres and dirt and the fibres are more or less matted and form lumps and neps.

Neps do not affect the production of the speeders to any great extent, but in the spinning room the evil of them is felt in full force.

In attenuating the roving a break is often sure to follow the pressure of a nep, with the result that the spinners are not able to keep the warp up, and the production falls off. When the neps fail to break the thread on the spinning frame or mule, the spooler tender is kept on his feet repairing broken ends, unless the guides are set wide.

If this be the case, the warper tender and weaver have to take what the spooler tender escapes.

When the guides are set close, but few neps will pass them, and the spooler, in his hard labor to keep up the end, will make many knots that will bother the weavers. Perfection is the only way to success. Success will overcome all imperfectness.

# SCOURING, CARDING AND COMBING.

### ESSAY NO. 5.

Following are my ideas on scouring and carding for worsted. The heat of the water should, in my opinion, never exceed 120 degrees for the most greasy wools. Wool which is overheated will have its serrations weakened, its natural curl taken out, and the fibres will be harsh and difficult to card into a satisfactory sliver. The finished yarn will be twitty, rough and tender.

The same can be said when soaps too strongly alkaline are used. Potash renders wool soft and silky to the touch. Soda in any form used with wool has a tendency to make it hard and brittle; also the wool a poor color.

The carder should know or understand how the moisture of the wool should be. When it is ready for the cards the preparing of it previous to its transfer to the carding and combing room should have due attention. If the wool be too wet it will mat and roll in the card, and the doffer will turn off a sliver so full of nibs and slubs that no amount of combing can perfectly clear it. If too dry, especially if the card be running at a high speed, the wool will be slippery and there is danger of the fibres getting broken, and shoits flying out, which makes uneven and tender sliver. To obtain the best results the wool must be in good working order and the speed of the doffer and feed well regulated to suit the material. The cards should be well ground, with clothing to suit the nature of the wools, and no irregularities in the teeth of clothing.

# RIB KNITTING.

### ESSAY NO. 6.

In knitting rib tops three things are of the greatest importance: The setting of the machine, the quality of the yarn used and the condition in which the machine is afterward kept.

The dial needles should be set just a little to the right of the centre of the cylinder needles, so that they will come directly in the centre when the work is run on. The dial stitch "cam" should draw the dial needles in just far enough to cast off the

stitch freely. The "welt cam" lever should draw the dial needles out just as far as the welt cam pin will allow. If this is not done, tuck stitches are sure to result. The dial should be set so that the thread will strike the dial needle at a point on the latch almost at the rivet and high enough to allow the welt to pass under it.

The yarn carrier should be set high enough to let the dial needles pass under it without the hook catching and just far enough out to prevent the cylinder needle hooks from rubbing against it, which wears the face of the hook and bends latches, therefore making bad work. It should be set just far enough to the right to allow the latch of the cylinder needle to just clear it when closing on the stitch.

The cylinder-stitch cam should draw the needles down far enough to make the stitch uniform with that of the dial. The slack course should be made just large enough to be seen plainly and about a half inch from the welt.

The quality of the yarn used is one of the most (if not the most) important things to be considered in making first quality goods. If the yarn is not free from bunches, sticks and heavy and soft places, no amount of adjusting or setting of cams will produce good work, and a large increase in needle breakage is sure to result.

The condition in which the machine is kept is a very important factor in the production of good work.

In order to avoid as much as possible the breaking of needles the cams should be kept in a good, smooth condition, for if a cam becomes rough or worn it is liable to break needles at the butt, which damages the cylinder or dial and always knocks something out of adjustment. The machine should be kept clean; the cleaner it is kept, the better. The operator should keep the waste from collecting on top of the machine and around the yarn guide by blowing it off at short intervals during the day.

The grooves in the cylinder and dial should be cleaned out as often as possible, in order to avoid the wide stitches which will result if dirt or waste is allowed to collect under the needles.

If these rules are followed and the adjustment is done with care, good, elastic work is sure to result.

# WOOLEN AND WORSTED WEAVING.

## ESSAY NO. 7.

Before beginning an article on the process of weaving, it is well to decide where this process begins.

To my mind, the mental process of weaving begins at the designer's desk, while the mechanical process does not begin until after the warp is in the loom. There are, of course, mechanical processes, such as dressing, spooling, twisting, etc., between, but as these do not come under the direct head of weaving, I will omit them.

I will touch the subject but lightly, as to go deeply into it would necessitate the writing of a volume, whereas I intend to write only an article.

I will suppose that I am asked to make a piece of woolen and also a piece of worsted goods, but as the kinds are not stated, I will make something very simple in the line of each. For the woolen I will make a simple shepherd's plaid with over-plaid, 17 ounces per yard from loom, and 72 inches wide in reed between selvedges. Right here I run up against four distinct questions, and a number of indistinct ones: How many warp threads per inch? How many fulling threads per inch? What counts of warp? What counts of filling? As this is a piece of woolen goods, it will probably be shrunk in finishing 15 per cent. in width, and 10 per cent. in length; therefore, the warp will be 5 per cent. heavier than the filling, and there will be 5 per cent. more picks than there will be of warp threads.

Then there is the take-up in weaving to be considered, but as this amounts only to about .18 of an ounce per yard, and as I am not splitting hairs, I will omit it, and say that the yarn will be required to weigh 17 ounces per yard of cloth, and that one-half of this yarn will be required to be 5 per cent. heavier than the other half; the heavier yarn being warp.

Then, 17 divided by 2 equals 8.5, and 5 per cent. divided by 2 equals 2.5 per cent.; 2.5 per cent. of 8.5 equals .2125, which I will call 1-4 ounce and add to my 8.5, making it 8.75 ounces, which subtracted from 17 ounces leaves 8.25 ounces. Therefore, there will be 8.75 ounces of warp, and 8.25 ounces of filling required per yard.

Now what will be the counts of my warp? and how many threads per inch? What will be the counts of my filling? and how many picks will there be per inch?

I will deal with the warp first.

As there are to be 8.75 ounces of warp, and as the standard for woolen yarn is 100 per ounce, I have 8.75 times 100 equals 875 ends of one-run yarn (no figuring required; just strike out the decimal point, or add "00" if there is no decimal, and if there should be one decimal, strike out the point and add "0"). But supposing I want to use finer yarns, say 4.5 run: Then, 4.5x875 equals 3937.5; but I can't use a half thread, so I strike out the .5; and then 3937 divided by 72 equals 54 ends per inch, and 49 ends over; 3937 minus 49 equals 3888; the 49 ends I will replace with ends enough to make a suitable list, say 24 on each side, 1-2 inch in reed.

Before going farther it is well to know whether or not 54 ends of 4.5-end run yarn will go into a cassimere weave, as that is the weave on which I have decided. In order to find that out, I should know the contents of my filling. As there are 54 warp ends per inch and 5 per cent. more picks of filling than warp ends, 5 per cent. of 54 equals 2.7; then 2.7 plus 54 equals 56.7 picks per inch. Then 73 inches (including selvedges) in reed: 73x56.7 equals 4139.1 yards of filling required for one yard of cloth. Then 4139.1 divided by 100x8.25 equals 5.016 or a 5-run filling.

Of course I knew it would be a 5-run filling, since the filling is one-half ounce lighter than the warp, and a half ounce is a half run. It was the width of selvedge that caused the fraction .016; I used the figures merely to show the working process.

Now I have a 4.5-run warp and a 5-run filling; how many threads will fill a 2—2 weave?

Mean size of yarn, 4.75 run, and 4.75x1,600 (standard for woolen yarn per pound) equals 7,600. The square root of 7,600 equals 87.25 (nearly); then 87 1-4 threads less 16 per cent. will lie side by side in one inch.

Sixteen per cent. of 87.25 equals 14 (nearly); 87.25 minus 14 equals 73.25, which is the number of 4.75-run threads that will lie side by side. But a 2—2 weave won't take that many, nor do I want it to, as the cloth would be too sleazy if it would. I want the weave to be filled with 54 or 56 threads, warp and filling, that is, 110 threads in all (per square inch).

73.25 ends divided by the title of the weave, that is to say, 2 and 2 equals 4, and 4 into 73.25, equals 18.31. Now I subtract my 18.31 from my 73.25, and the remainder, 54.94, is the number of ends that will fill the weave. This, of course, is approximate, not exact. We have no rule by which we can figure

exactly the number of a certain size of yarn to fill a certain weave.

It will therefor be seen that I need 3,888 yards of warp, with an allowance of, say, 2 per cent. for take-up in weave, and 4,139.1 yards of 5-run filling to make one yard of cloth.

As I have already gone much deeper than I at first intended, I will briefly lay out my dressing draft thus:

Dress: 48 ends in pattern, 81 patterns equal 3,888 ends.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Light .................. | 2 | | 4 | | 4 | | 1 | | 2 | | 4 | | 4 | 2 |
| Dark .................. | | 4 | | 4 | | 4 | | | | 4 | | 4 | | 4 |
| Fancy .................... | | | | | | | | 1 | | | | | | |

12 harnessed: 3,888 divided by 12 equals 324 heddles on each, 2-list harnesses—straight draw.

Reed: (3,888 divided by 72 equals 54; divided by 4), 13 1-2; 4 in dent.

Here I leave the subject, until I am called upon to find the centre of reed. I look carefully so as to make sure of its being a 13 1-2. I then look for the length, and find it, say, 88 inches. I then measure off 73 inches from one end, carefully subdivide the remainder, and mark the point of subdivision, at which point the drawing in hand will begin to reed the warp.

When the warp is ready, we place it on a truck and tie strips of cloth, on which we have spread powdered blacklead, around the friction heads; this is to allow the beam to turn smoothly during weaving.

We then put the warp in the loom, and hook up the harnesses. Whether we hook the tops or the bottoms first scarcely matters; each shoe has its own way. If it is a Knowles loom, we secure the reed, and then tie on the leader; if a Crompton, we tie on the leader first. We adjust the temples, see that the hooks of the heddle shafts do not crowd the heddles one way or another, then we turn the head by means of the hand crank carefully, so as to be sure that the harnesses are all free. We then throw in a few picks carefully by hand, then lock the head motion, and weave a heading.

We next raise the harnesses, one at a time, and look over the warp threads carefully, lest there should be mistakes in dressing or drawing in.

I will not discuss the different methods of finding the change gear, as I have already exceeded 1,000 words and am not finished yet; only this: If the change gear is a driver, the number of picks times the gear gives a constant dividend, and if the

change is a driven, the picks divided into the gear that gave them is a constant multiple.

In order to avoid a complicated box motion I will use a simple filling chain, using two shuttles of dark, one of light and one of fancy, taking care that the right color goes into the proper shed, in order to get the desired check effect. I now look at the shed and see that the threads are not scattered, and that the lower ends are as close to the race as possible, but not close enough to chafe. There should be weight enough on the beam friction to hold the cloth steady, and if it takes the picks too hard, the cylinders of the head should be set as early as is consistent with the perfect working of the head. Some men, and men in authority, too, claim that the changing harnesses should be together when the reed is up to the fell of the cloth—that the picks are going in easiest then. I say that these men have a perfect right to think that way if they want to. "A man's mind is his kingdom," even though it be a fool's paradise; and he who has not tempted the fool-killer at one time or another is a Solomon, indeed. I know the contrary to be true from practical experience, just as I know that four and two do not make seven.

The loom should be kept clean, and carefully oiled; the sweep of the pick motion should be kept long, rolling and smooth, and the gearing should be kept snug. Discipline should be resorted to, and the room should be kept clean, so as to impress neatness on the minds of the operatives. Mispicks, long threads out, filling, drawing-in, etc., should be carefully avoided.

The warp should give out at each beat of the lay and not drag, or stick and then jump. As there are 56 picks in an inch of this piece of cloth, the beam should pay out that inch in 56 distinct installments, and the take-up should be set so that there should be no possibility of its missing a tooth, or taking up a tooth too many.

With a fairly good weaver on the loom, I think that the rest of the process ought to take care of itself.

I will now turn my attention to the worsted and finish that briefly.

After deciding on what to make, I work it out as I did the woolen, but using the worsted standard of counts, that is, 560 yards to the pound for number 1s. If I use some ends of silk, I will convert the standard of silk (840) into the worsted counts, so as to have only one system in my work, thus: If I

have a 20s silk, 20x840 equals (its own counts and its own standard) 16,800, divided by 560 equals (the worsted standard) 30s worsted. And in finding the number of ends that will lie side by side in an inch I will subtract 10 per cent., whereas in the woolen I subtracted 16 per cent. I will also slay the worsted closer, and weave it more tightly. I will also take great care to avoid the making of unnecessary waste, as this yarn is expensive.

## COTTON CARDING.

### ESSAY NO. 8.

The cotton carding machinery of to-day is as nearly perfect as can be hoped for, at least for some years to come. There are defects, however, which may be overcome to some extent by a more carefully designed mechanism.

One of the faults of the revolving top flat card is the unevenness of the top flats, notwithstanding they are claimed to be ground within one-thousandth part of an inch of each other.

Every carder knows that it is sometimes only possible to have a few flats on a card set "just right," i. e., if you want them set snugly to a No. 7 gauge, perhaps you can only get a few of them down to this gauge; the others, by having shorter wire, will be "off" to perhaps a 12 or 14 gauge. This defect can only be remedied by continual grinding of the flats until they are all alike and will set to the same gauge. There is considerable difference of opinion among carders as to the setting of cards, and it is also true that some are jealous of their knowledge as to how to get best results. This is against the spirit of the times, and he who would try to conceal "useful knowledge" is self-conceited and narrow-minded, to say the least. Of course it would not be considered wise for any man to proclaim his discoveries from the housetops, but in this age of newspapers, magazines and journals, devoted to every art and industry conceivable, knowledge of any kind is, and of right ought to be, public property. Upon the common law that it is a fraud to conceal a fraud, some have the idea that it is wisdom to conceal wisdom, and who is the practical cotton mill man that will say it requires no wisdom to set a card to get clean and good running work? Some years ago, while em-

ployed as carder and spinner in a mill of 10,000 spindles, it was my privilege to do a great deal of experimenting on card setting.

In the same city where I was located there was another mill equipped with the same kind and make of machinery, using the same grade of cotton and producing the same class of goods. In the mill where I was the spinning ran unusually well, while at the other mill there was continual complaint of bad running spinning, especially during hot, dry weather. Neither mill at that time was equipped with humidifiers. After months of search and comparison of speeds, drafts, settings, etc., it was decided, between a few of us, that the difference in the running of the work was due to the difference in the settings of the feed plate to licker-in. I had frequently been told that my carding did not look as well as the other mill's, but that my spinning ran one hundred per cent. better; on the grade of cotton we were using and the numbers being made I set my feed plates to 19-1,000, while the other fellow, who was my superior in age and experience, set his feed plates to 7-1,000.

The "Reporter" readers will pardon the mention of this personal incident, as I only wish to show that an experience, covering many years and much experimenting, has proven to the writer that the best carding does not always mean the best spinning.

Cotton can be worked to death, while it is not work that kills man, but worry. The cotton fibre is strongest, and contains the maximum amount of natural twist, when it is first picked from the bolls, and each process from the gin to the loom tends to weaken the fibre. The cotton gin does much damage to the fibre when the cotton is ginned immediately after being picked, for it is then hardest to separate from the seed. If the seed-cotton was stored for, say, four weeks after it has been picked, before ginning, the fibre would absorb oil from the seed and become more easily separated from the seed, resulting in less damage to the fibre.

The fibre should be subjected to as little wear and tear as possible in order to retain its length and strength. At the gin this idea should dominate and the fibre be taken from the seed as quickly and easily as possible, reducing the action of the saws on the lint to a minimum. At the pickers the idea to keep in mind and the thing to be done is to loosen up the

cotton, extract the motes, dirt and other foreign substance with as little beating of the fibre as possible.

At the card it should be borne in mind that it is not the amount of carding done that counts, but the least possible strain put upon the fibre to obtain the desired results. The card should loosen up and disengage the fibres, remove dirt, nits, short or immature fibres, etc., and comb out the fibres into a partially parallel order, without any unnecessary action on the same.

At the drawing, the object sought is to lay the fibres parallel and to do this without any injury (if possible) to the fibres themselves.

As to the number of processes required, opinions vary considerably, but suffice it to say, that any more than is absolutely necessary is not only unnecessary, but injurious to the fibre, and adds additional cost to the manufacture.

At the fly frames the attenuation is carried forward, and if it becomes necessary to add twist to the roving, care should be taken to preserve the strength of the fibre, and any unnecessary twist at these processes not only reduces the production, but adds strain to the fibres at the next process. You will find it pays to preserve the strength of the fibre and I have long sought to find out the best methods of so doing.

## KNITTING.

### ESSAY NO. 9.

A new machine just from the shop should always be carefully examined by the knitter, for the builder is just as liable to make mistakes as anyone else. By carefully going over the machine you may avoid trouble in the future. If a dial does not set up close to the cap, all the way around, as it should, it will give you trouble.

The machine may run for months until you have a smash; then you will have trouble ever after. By placing the dial in a lade with a good strong arbor through it, you can tell if the defect is in the dial. If your dial is out, put three set screws between the ones that hold the dial to the collar. Then adjust set screws till true. You will always find these set screws a benefit to you, and after you find that it has not brought the

dial close up to the cap, as the hole is not straight up and down, I do not advise you to try and fix the cap, but send it back to the shop, as they will put a bushing in.

Lower the top of the machine till you can just turn a needle around between the dial and cylinder. Try this all around the machine. If your dial sets closer on one side than it does on the other, it will give you lots of trouble, especially on fine work. Your machine will get hot and in time wear the cylinder. It is a very bad defect and should be fixed right away. It will cut holes and your cloth will not lay out right for cutting, for the machine is knitting a long stitch on one side and a short one on the other side.

When drawers or sleeves are cut from this cloth the seamers cannot get the seams straight, which gives the sleeves or drawers a crooked shape; then the inspector throws them out for seconds.

A new machine should always be leveled before operated, and it will wear level and run easy. To get a good elastic cloth from a machine, by turning not more than 1-32 of an inch off of the dial or whatever your cast-off cams will allow, you will find that you have a very nice piece of cloth; the wale will be closer and more elastic.

I do not approve of a knitter taking a set of cams and grinding them himself, for he cannot get them all of the same shape or as smooth as they were; if he ground one cam and sent it to the shop, they would make a set just as he wanted them.

I find it a good point to have draw cams ground to cast off one needle at a time so that the stitch is properly formed and needles fully raised before drawing the top needle in. It avoids cutting holes in tender places in yarn or knots.

Knitters using magnets to fish out butts should be careful in not rubbing the gids with the magnet, as they will pick up the latches, making the machines drop stitches; then you have trouble of your own if you don't see what you have done.

Good yarn, good winding, good operator constitute the best stop motion.

# A FEW HINTS ABOUT SPEEDERS.

### ESSAY NO. 10.

One thing that every carding overseer should look out for is to keep every spindle of his slubbers, intermediates and fly frames running. It takes but little carelessness on his part to have the spinning room waiting for roving. Every loose or worn bolster or spindle gear, or a bent or broken flyer that causes the breaking back of an end, should be reported by the tender at once. In some cases the fixer or second hand is too busy to fix the trouble at that very time and lets the spindle wait. Before the end of the week there may be a dozen stopped, and a dozen spindles on coarse roving mean a good many pounds production lost.

A strict rule should be enforced by the overseer that once a week, at the very least, the fixers should make it a special object to look over and straighten out every little trouble about the spindles.

There is nothing more disagreeable than when a frame is started up to hear a couple of flyers striking together.

The trouble is generally caused by the spreading of a leg of one of them. If this is not the cause, then you will probably find that one of the spindles is out of plumb, letting it slant toward the spindle on either right or left. The tender will turn this spindle a quarter way around and it will run till the next doff. When the frame is doffed, the flyer will be turned back into its proper position by the doffer and the same "striking together" repeated. This, if not speedily remedied, will destroy both flyers and pressers.

Around coarse speeders there will be necessarily a good deal of waste, caused by flyings, broken ends, etc. Now this waste is always falling down back of the frame and getting into the gears and racks. This is very noticeable in the tension rack. A small bit of waste clogging this rack will cause the frame to run over and break all the ends down, thus necessitating a delay and loss of production, not counting the hard piecings for the spinner to handle.

Lifter racks will get filled with this waste, but the trouble is not so quickly shown as with the tension rack. The waste will pack into these lifter racks and gears almost as hard as iron, causing them to run exceedingly hard, and finally the teeth of the racks or gears, or both, will be broken or forced

out of gear. The carriage will stop its traverse and a ridge will be made on the bobbins. It is not a ten minutes' job to put on a new lifter gear, especially at the head of your frame, level up your carriage, piece up and get the frame running—more loss of production, not counting the bad strain the whole speeder had to stand. A couple of breakdowns in the next few days, caused by this same smash, often occur and show points that were weakened. Look these racks over once a month and pick out all waste.

Go into a mill and stop a speeder on the change with the carriage down. Take hold of the driving pulley with both hands and see if you can start the frame. Maybe you can, but very likely you cannot. Nevertheless, if a speeder is in good condition, one ought to be able to turn it easily with one hand, at any position of the carriage. The two main causes of this running hard when the carriage is down are tight spindles and spindles out of plumb with their steps. You may be able to lift every spindle out of its step when the carriage is up, but, with it down, you probably will find a third or more of them immovable. To remedy this: Doff the frame. Remove all flyers, leaving all spindles bare. If your carriage is down, run it up by hand and your tight spindles will rise with it, but a better way is to disengage your rolls and run the carriage up by power. Take out every spindle and after cleaning out every bolster, wipe spindles perfectly dry. Plumb spindles. Run the carriage to its lowest point and plumb the spindles again. See that all the steps are properly oiled and then put on the spindle gears. Oil your bolster gears, but do not put a drop into the bolsters. Connect your rolls, etc., and your speeder will run with quarter driving belt.

I wrote, above, not to oil your bolsters. Now I suppose that I will hear from you. You will say that the bolsters would all be worn out in two months' time. I say that they will not if you have your spindles plumbed correctly. Put your finger on a spindle out of plumb and you will feel a strong vibration. Try it on a plumb spindle and you do not feel any. The vibration is caused by friction on the sides of the bolster. A truly plumb spindle or one very nearly so causes almost no friction at all in the bolster. Accordingly, if we have no friction, there will be no wear. If this bolster is oiled, the flying lint collects on the sticky spindle and at every change is packed into the interior until the spindle sticks. A really tight spindle will do more damage to a frame in one change

than would occur in a two years' run. With no oil in the bolsters, the spindles will never get stuck, and as to the wearing of the bolsters, I have a pair of 10-inch frames that have not had a drop of oil in the bolsters for over four years. There is never a tight spindle on them. You can turn them easily by taking hold of the bobbins on the spindles. The bolsters show not a bit more wear than before oiling was stopped. Twist is a very important item about speeders. Many overseers make it a rule to run just as little twist as possible. That is all very well, if they stop at possible, but a good many of these overseers go beyond this and run too little. A good deal better rule would be to run as much twist as possible, for production depends not so much on running little twist as on running the frames. One end down stops the production of the whole frame. Just a little more twist would have saved it and the frame kept running. By this I do not mean to run excessive twist, but I do mean to use judgment.

High speed does not mean large production. It generally means destruction to machinery and hard-worked help. I have seen a pair of slubbers changed from a 16-inch driving pulley overhead to a 13-inch and the same number of hanks obtained and better work, while the tender sat down and took it easy.

Some parts of the mill may seem insignificant, and able to run themselves. If they are, why have you been paid to look after them? The best man is not always the one who can fix a bad smash in the shortest time, but the one who can prevent the smash by keeping the machinery in order.

## WOOL CARDING.

### ESSAY NO. 11.

Carding being one of the first and principal processes in the manufacture of cloth, much care needs to be exercised and the machines closely watched at all times, for work spoiled in the card room cannot be made perfect by any of the processes that follow.

Now in the card room we have three main objects to accomplish: First, good, smooth, even roving; second, as much of it as possible; third, to make as little waste as possible. So we

will take the first breaker and see that it is in proper shape; feed rolls and burr cylinder good and clean, for if not they will carry the stock to the main cylinder in bunches, causing unnecessary strain on the wire of the cylinder and first two workers, seriously hampering the work of the machine which has been put in good shape; cylinder true, level and sharp, having been ground with a traverse wheel, not run too fast, as they are apt to spring in the centre, causing cylinder to be low in the middle; workers and doffer all true and sharp. We will set the machine for stock to be carded.

Here is where a carder's judgment counts for much, as no rule can be made to do for all kinds of stock; but set the machine just close enough to make it do the work required of it, and no more, as the object is to preserve the length and strength of the staple as much as possible, being sure that the fancy is doing its work well. Now we will look to the Bramwell feed and see that belts are all tight, so as not to slip, and see that the scales do not receive their weight before the pin that releases the clutch has returned to its original position; also see that they do receive their weight some little time before they trip; and do not have stock on feed table too heavy, for the feed rolls will be apt to crowd it back and then take hold and carry through the heavy place so formed. Still the feed table must be well covered and not have any holes or bare places.

We will now pass on to the second breaker and grind it as we did the first. Here we have a Bates or Apperly feed. The stock on this should be packed as closely as possible, so as to get all the doublings we can. A good idea is to run the breaker doffers fast, which will give a smaller drawing and make a nicer feed, less liable to cause bunches. A card will also make less waste with a fast doffer. Now as to the finisher. Here is where things must be about right. After getting workers and cylinder in good shape by light grinding, take the rings to the grinding frame and grind very light, using plenty of oil, so as to make the point smooth, and after grinding have several rings made of fancy wire to fit the traverse wheel, slip them on and set into rings about 1-32 of an inch and let them run about twenty minutes or one-half hour, and you will have a good smooth point, one that will take the stock uniformly and deliver free and easy without any twists, if draft of strip roll is as it should be. I find that a gain of 4 per cent. is about right, that is, while the surface of ring is traveling 96 inches, the

surface of strip roll should travel 100 inches. This is just enough gain to prevent stock from running up between ring and stripper, pinching and causing a twist. Much could be said about the speed of the different parts of a card, but we have so many different classes of stock and sizes of yarn that it is impossible to set any rule.

The heavier the work, the faster it is necessary to run the leader, and tumble workers should be run just fast enough so as not to crowd the stock on to them, as wire will only hold a certain amount of stock; if more is forced on to it, it will roll and nub up. Run breaker doffers fairly fast. Cylinders for low stock should have a surface speed of about 10,000 inches per minute; for good fine wool or wool and cotton mixes 12,000 inches per minute will be found sufficient. A set of cards, prepared as above, should give a good, sound yarn, plenty of it, and with a dickey on the breaker doffers to keep the point clear, should make but very little waste.

# WOOLEN AND WORSTED WEAVING.

### ESSAY NO. 12.

In the operation of weaving, the first question to consider is: When does this commence? We answer, after the warp has been put into the loom, proper chains put on and tied in, started up and looked over, or when the loom is turned over to the weaver. Then we may say the real operation of weaving commences.

The first thing for the weaver to do is to familiarize himself at once with the general design or plan of the pattern, whether that be stripe or check, and for our purpose we will say it will be a check whose plan is as follows:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Red fancy............ | | | | 1 | | | | | | | | |
| Green fancy.............. | | | | | | | | | 1 | | | |
| Olive ................ | 4 | | 4 | | | 4 | | 4 | | | 4 | |
| Black ................ | | 4 | | | 3 | | 4 | | | 3 | | 4 |
| | x | 5 | | | | | | | | | x | 4—96 |

To be crossed in the filling, same colors, filling chain to be 104 bars long, and cassimere weave employed. Having done this, the weaver will need to learn how many shuttles he is running and where the colors are in the boxes.

Then he must carefully arrange the filling in his filling box, each color by itself. (Not thrown in indiscriminately.) Then he is ready to commence.

Now as the loom runs along, every loop and knot and lump of every description appearing on the surface of the cloth must be made the object of the weaver's close attention to see if it is a broken thread, a slub, or is making a hole in the cloth, and receive the proper attention.

Every time the weaver changes his shuttle, he should examine the thread of the shuttle coming out of the loom and the one going in, holding both up to the light; in this way he keeps himself checked up all the time. This does not necessarily delay the running of the loom; it can be done while the loom is running, but must be done before he puts the shuttle out of his hand.

Each yard of cloth as it rolls up must receive as much attention as the first yard, and if it receives it the result will be a uniform piece of cloth from the loom.

The weaver ought to keep himself busy all the time; if everything is running along all right in front, he ought to walk around to the back of the loom and carefully examine his warp, break off all the long ends of the knots made by spoolers and dressers and keep a close watch on the whole operation; in this way much time will be gained and a better piece of cloth produced than if these knots were allowed to weave close up to the reed and tangle with the adjoining threads, causing holes, floats and the throwing out of the shuttle.

Suppose now that while he is doing this, something goes wrong in front, and the weaver, when he comes around, discovers a float or broken pick of filling; he must at once stop and pick it out, and carefully start up again. There are usually two ways open to the weaver to do this: he can, if running a Crompton loom, turn his levers and take it out thread by thread until the error is remedied, or, if a Knowles loom, turn the wheel and, reversing his chains, go backward and make it right, or he can level his harness, tear the cloth in a number of sections to the bad place, and pick it out with a comb. If he has not far to go, usually the former way is the best, but, if some distance, the latter is better. If the colors are not too close in shade he can count his pattern, set his chain, and after he has pulled his warp backward, go ahead again; but if he cannot count his pattern, the usual practice is to pick out to a

certain point, generally one of the overplaid colors, but some place that he is familiar with, and start again.

This operation must be performed with a good deal of skill, so that in starting up again the cloth may be of the same weight after as before, care being taken that he does not make a heavy or light place or that it is not light at the sides, though all right in the centre, the latter condition being caused by the cloth sticking in the temples, which can usually be remedied by the weaver giving it a little extra pull backward with his hand at the sides.

This is at least one point where he will need to exercise patience (he is poorly equipped that has none), for after he has woven, say, half an inch, he should stop and make an examination, and it will oftentimes turn out that it is a bad start and must be picked out and tried again.

The best way which the writer knows is for the weaver to familiarize himself with the tension of the cloth as it weaves, then endeavor to have the same tension when the fell of the cloth is about where it is in weaving.

He is the best weaver who considers his work his art, and worthy of his best pains.

The loom fixer will have a duty to perform to secure good work from the loom. He ought to keep his eye on that loom until the weaver has woven several yards. By this time it will develop whether or not the loom is doing its best work. If the warp breaks excessively, the loom ought to be examined to find the cause (there usually is one), which will often be found more quickly by the fixer than the weaver, and the attention is greatly appreciated by the weaver and by the management.

The overseer ought to be a man who thoroughly understands weaving and is qualified to give instructions on all points, and one who, if an error is pointed out to him, either in the draw or pattern, can quickly show how to remedy it.

Courteous attention and civility from loom fixers and overseers will have their own part in the process of weaving.

# WOOLEN SPINNING.

### ESSAY NO. 13.

My idea of what is needed to make a first-class spinning room is, first, an overseer who understands drawing yarn and fixing the mules so that he will get the best results and knows how to work with his help. For instance, a spinner makes a complaint that his work is going so badly that he cannot keep his ends up. Instead of answering him shortly or sarcastically, that that is his lookout, it is better to investigate and see just what the trouble is. In nine cases out of ten it can be made to run better. Say, for instance, his driving belt is too tight, which would start his jack too quickly; or it might be too slack, which would make the jack too slow in starting and cause a strain in the yarn; or his rim-band may be too slack and not start the spindles as quickly as it should; his scroll band might not be as tight as it should be and would let the jack draw unevenly; or his rolls might not be running fast enough, which would make twits in the yarn; or the roping might be too tight or the drum spool slack on one end of spool and tight on the other; or the mule might not be striking squarely one end before the other, or the friction might not back off the mule as it should, making kinky yarn. More might be said about kinky yarn, but it would take up too much space. One might have too much weight on his followers, which would strain the yarn, or, again, his quartering might not be set right. Any or all of the above would make the work run badly and cause general dissatisfaction.

Let me say right here that any man who understands spinning at all is able to make good stock run right along, but it is the overseer who thoroughly understands his business who is able to make poor stock run well. Great care should be taken of the spindle bands. Do not have them either too tight or too slack, for, if they are not right, considerable bad work will be the result. The collars should be kept tight. Do not allow them to become loosened, for it will not improve the running of the mule; neither should the steps be allowed to get loose and wear great holes in the step board that will increase the expense of running the room, but not increase the production. If all these things are carefully looked after, we will have a first-class spinning room.

# WOOLEN AND WORSTED WEAVING.

## ESSAY NO. 14.

The weave room is a very pleasant place when everything is moving along in order; the weavers and fixers being first-class, the yarn perfect in size and shade, the looms in perfect running order, the weave room well lighted with windows and electricity and having good ventilation, the warps received from the dressing room in a perfect condition, the warps drawn in and reeded correctly, and the warp and filling layout correct, with plenty of orders to run on the year around; but we fail to find all these things working so perfectly and smoothly. This, however, ought to be what every overseer should be trying to attain. There are many things to be looked after in a weave room that the overseer must keep in mind. If the minor things are neglected they will result in damage. I believe that this saying is true, that an ounce of prevention is worth a pound of cure. The overseer should get in close touch with his help.

It is a good plan to practice, when a new fixer or weaver arrives, to have a talk with them and tell them what you expect and what their duty is and make them feel that they are wanted. Always speak pleasantly to your help and be manly with them and you will get good results from their labor. The weaver must be kept steadily at work if you want large production. It pays to plan to have spare work for the weavers when they are waiting for a new warp. Help the weaver to earn a good weekly salary. The weavers are contented as a general thing when they have steady work, but when they are waiting a day or two at a time, they become discontented, as it has a serious effect upon their pocketbooks, as well as minds, and this discontentment leads to strikes. The overseer should see that the looms are kept in good running order and when the warp is running badly, he should have the loom adjusted to favor the warp. If these things are neglected, they cannot be made right in the perching room. There should be lots of attention given to the loom, weaver and fixer, if we are to get good work from the loom.

There are many things that originate in other departments that cause faulty cloth. We will take into consideration the yarn as it is received from the spinning room. If it is twitty or uneven and with fine and coarse ends caused by carding

and spinning, all these defects in the yarn have their effect upon the woven fabric. The dressing room has its part to do if good results are to be obtained in the weave room. I have in mind a covert cloth that was being woven and slack ends showed up very prominently on the fabric. These were caused by too little tension being placed upon the yarn while spooling; as this yarn was hard twist, it would double and twist together wherever there was a slack space. If the drawing in the warps in the harness and reeding is done by incompetent help it has a serious effect in the weave room—and how many wrong draws I have seen by extra heddles being left among the others. I have had my experience on single worsted warp yarn with wool filling and have had my share of uneven filling. Much of this work is woven on two looms and the filling run on two shuttles and the weaver would change both shuttles at the same time, thus causing a shady place each time he changed shuttles. The writer has overcome this by running the filling on three shuttles in four boxes, thus getting one pick of each shuttle, and not change more than two shuttles at a time. It is advisable to always count the picks when the filling is half run down on the bobbins. In small woolen mills, with from 30 to 60 looms, it is best not to mix the filling of the jacks. It is best to keep so many looms on the filling yarn of one jack and so on. By doing this, there will be better results. To avoid rolling selvedges, if the weave is twill with listing on regular harnesses, draw listing in so as to reverse twill; if listing on extra harness, use plain weave or basket weave on listing. The writer has in mind a cotton worsted warp with two threads of mercerized cotton, about one inch apart in pattern. These threads were drawn in the two back harnesses.

The result was that every time these two harnesses changed they opened so far that a greater strain was brought on these ends, and there not being ends enough on these harnesses to steady them they came up with a jerk, and as there was not any elasticity in the mercerized cotton they were suddenly broken. These two harnesses were on a plain weave. This breaking was overcome by dropping the harness wires connecting these two harnesses down on the lever enough to remove the strain. The designers should plan to have harness with only a few ends on front, if possible. I have seen warps with misplaced heddles in every pattern where there were two fancy threads and a break in the pattern and

the fixer and second hand pass them; the colors would show up all right, in looking the harness over. I have learned by experience that the only sure and safe way to avoid these mistakes is to go over the pattern with the layout; and if pattern does not correspond with the weave room layout. first see if the layout is like the designer's, as there may have been a mistake in making out the layout; if the layout is correct, there has been a mistake made in drawing in the ends.

The warp should always be measured to see if it is the right width in the reed before it is passed. Care should be taken to see if the sheds are adjusted properly to give a good clear opening for the shuttle and the take-up and let-off motion should always be examined. It pays to spend a few minutes and have things in their proper way and place. The overseer should have time to think and consider things in their proper light. Many overseers in small mills have so much muscular labor to do that they don't get rested enough to think and plan their work. Good results cannot be had in this way. The overseer should adapt himself to approaching those who are under his charge in a proper and pleasing manner; he should ignore petty grievances and look deeper than these, and crowd them out with something brighter instead, and by so doing he will not only brighten and gladden those about him, but the pleasantness will reflect back and make him a more manly general.

## THE LICKER-IN AND ITS ACTION.

### ESSAY NO. 15.

My attention has often been called to the working and action of the licker-in of cards. In feeding the cotton to the licker-in the action thus imparted to the cotton is identical with placing cotton lightly in the path of a body of coarse moving combers. It will be readily understood by the readers that serious damage would result should the cotton be pressed somewhat forcibly against the teeth of the licker-in, a feature which can be overcome by making the front portion of the disk plate of a peculiar shape.

If the feed plate is adapted to the kind of cotton under operation the ends of the longest fibres in the fringe of cotton

will project to a point opposite the most protruding points of the disk plate, and are easily withdrawn, whereas if this is not the case the resistance to their withdrawal is more than likely due to the resistance of the fibres about them. It is a sign that the disk plate is not adapted to the kind of cotton under operation, the extra grip upon the fibres being due to the pressure of the feed roller on the other end of the fibres. When again the staple of the cotton under operation is shorter than the plate is adapted for, the fibres are liable to be detached from the laps in numerous bodies instead of singly, which in turn causes the web when taken from the doffer to have a cloudy appearance. When this is the fault, it will be easily observed that the cotton passes on the under side of the licker-in in patches. Of the three faults referred to, a too heavy feed will produce the most damage. In order to get the most benefit of the action of the licker-in, the cotton should be fed to it gradually, so that the fibres are subjected to as little strain as possible and then the cleansing and carding actions will be more thoroughly accomplished.

At the same time, the lap should not be thicker than the licker-in can effectively treat, nor lighter than the maximum amount possible. By using a maximum feed it allows the feed to be run at the lowest rate for any given amount of production. After the maximum feed has been ascertained the weight of the laps should not be changed and should not vary from eight to sixteen ounces, according to width as well as make of cards and the kind of cotton used. This part of the card is all important, and is largely responsible for the quality of work turned off, and its capacity for cleaning the stock of dirt, motes, leaf and lumps makes it an armor of protection for the wire on the cylinder and flats, and its duty well performed will cut down the cost of grinding and double the life of the clothing. To bring the licker-in up to its highest efficiency will require going into minor details, and we should proceed in this direction by taking off the cop and examining the wire.

If it is very dull or forced up from rubbing the motes, knives or feed plate, the best way is to take it out and place it in some kind of stand, or take it to the lathe, run it backward slowly, and with a handsaw file run in all of the spiral grooves from one end to the other. It is best not to have the wire ground to a fine point, for if extremely sharp it will cut up the stock and make a great quantity of waste.

# WOOLEN SPINNING.

## ESSAY NO. 16.

An overseer of spinning, in order to get good yarn and production, should be a good mule fixer, thoroughly understand drafting and drawing of yarns and should have a carder make roping on the card of the right weight in proportion to what the yarn will draw in spinning. Too many times we see the racks full of spools and no production. This is caused by not getting the roping of the right weight from the card, and trying to draw half way out of stock that would not properly draw one-third of the way and run good. The carder and spinner should work together as far as the weight of roping and good work are concerned. The overseer of spinning should watch his machines (mules or jacks) and see that spools have uniform rubbing—not have one end of the spool running up and the other end tight; report to the carder the number of card and call his attention to rubbing. You cannot gear a mule to run spools that need fixing at the card. Note the difference the rubbing will make, especially when you are spinning and drawing fine stock, when it is not uniform on spools. I have sometimes been puzzled about some soft bobbins being found in each set and looked for all those things that would make them, including slack spindle bands, loose cylinder, faller weights dragging on floor; but happened to have four spools in mule that were soft on one end of spool and let them run until the set was doffed, and there were my soft bobbins, which I had worried so much over. Report to the carder about all fine and heavy ends and twitty roping by sending him ticket off spools, from that lot. Get your spools right on drums, then go to your rollers and see that there is no back lash in them, which will show in yarn in twits if mule starts out too fast. Do not have drawing out of rim belt so tight that you have to steady your mule with rim band, to hold it steady, which is often done. Do not tighten rim belt when the trouble is with backing off friction being in the gear and binding on the mule. Keep good faller wires on the mule and reasonably tight, so that the faller fingers will not be continually out of line, making bad bobbins and waste, which is quite a worrisome thing when you have your waste charged to your department. How many make the mistake of putting too much weight on fallers and binding the mule to get good

winding, when the trouble is with the quadrant not being set right. See that builder is set right and builder rail dwelling just enough on shoes to make a nice bottom on bobbin or cop, which will save waste and increase weaver's production. Have discipline and confidence enough among your help to make them watch their work and have the quadrant handled right, which makes a large difference in winding. The overseer should go around the room and inspect for himself each mule and know what condition his department is in, how machines are oiled and taken care of, whether they are making any amount of bad yarn and waste, and from what cause. This is sometimes caused by putting on new scroll band and letting it stretch too low on the scroll, causing ends to crack off, or having rim band too slack to drive the cylinder and spindles or drawing out clutch not having enough spring attached; kicking when mule starts out or mule not being checked right and slamming, when going up to rollers; drawing-in bands getting on the small part of scroll too soon; mules not being square, mostly caused from not having equal tension on each one to hold mule square. Especially when making double and twist on mules, any of these faults will cause trouble. The overseer can do more for the mill that employs him by being around the room, teaching the help, cautioning where necessary about bad piecing and waste and showing where each one's interest would be in making good work. As a general thing, there are always good and bad lots, but watching and doing the best we can for bad lots is where the art comes in. The best way I find is to have a slight difference in wages for the best help, making them take bad work, if there is any in the room, thereby getting good production from all machines; whereas, if they all received the same pay, they would be dissatisfied when they got bad lots, which sometimes happens in the best mills, from different causes.

# WOOLEN AND WORSTED FINISHING.

### ESSAY NO. 17.

The finishing of woolen cloths being different in principle from that of finishing worsted cloths, it is useless to attempt to treat of them in one essay, and therefore we will confine our-

selves to the consideration of the former in this essay. With very few exceptions woolen cloths depend upon the fulling process for the proper finish, and given a properly constructed fabric, it is up to the finisher to produce the finish required. The processes preceding the fulling need not at this time be considered, so that the fulling may at once receive attention.

The finish wanted regulates, to a large extent, the operations at the fulling mill, but the making of the soap is of even more importance. The usual practice in making the soap is to have it strong enough in point of alkali to properly start the grease and to have it heavy enough to last through the operation of fulling. But in order to produce a good felt on the goods and still have them feel soft and pliable it is not the best policy to have the soap of just the body required for the fulling process, for the general feeling as well as the looks of the goods will be much improved by having the soap of a much heavier body than that and any seeming waste of soap will be more than offset by the improvement in the feeling. The felt obtained with the use of a heavy-bodied soap will be much finer and there will be an absence of that stiff and boardy feeling which is often noticed on felted goods, provided the process of fulling is kept within reasonable bounds; that is, not extended too long. To avoid this latter it is good policy to run the goods in such a way as to bring the most possible of them under the rolls. While the goods are lying in the mill they are not fulling, as that process only takes place at the rolls, where the pressure is applied. With a good-bodied soap to act as a cushion and lubricant the fulling process will in such way be much shortened and the results will be much better in the end. On cassimeres it is usually the habit to run one piece on a side of the mill, the capacity being such that there would not be room inside of the mill for more than that, and in such cases it will be found of much benefit to double the goods in the mill. This will bring double the amount of cloth under the rolls and at the same time the capacity of the mill is not overtaxed. When the mill is too full, there is no chance for the goods to open in their passage and the danger of creating streaks and mill wrinkles is great, especially where the fulling process requires more than a couple of hours. By doubling the goods in the mill, they will come in contact with the pressure just twice as often as they would if run single, and therefore the fulling process is hastened, but at the same time the cloth receives as much treatment as it would the other way. But it

is not alone in the shortening of the fulling process that the benefit of this practice is observable, but on account of the greater volume of cloth under pressure, there is more give or resiliency, and this will keep it from becoming stiff and boardy, while the felt obtained is just as close. When the soap is made heavier than what is actually required, the danger of its becoming exhausted during the process is avoided, and the washing can be much better performed. The use of soap or scouring liquor at the washer should be entirely abolished except where the goods are to be washed before fulling, for its very use indicates that the soap used for fulling is not trusted to satisfactorily perform its mission; but if the fulling soap is made right it can be depended on to do its work, and any additional soap used at the washer is a willful waste and only makes it so much harder to remove all of it in the rinsing. A fabric, however, which is not free from soap is not free from dirt, for it is impossible to have a fabric clean unless all the soap, which holds the grease and other matter in suspension and is intimately combined with them, is completely removed. It is too often accepted as sufficient when the goods have run their allotted time in the washer, and even if soap shows itself when they are extracted it is overlooked, and to this fact may be attributed the inability on the part of some finisher to produce a bright and attractive-looking cloth when it is finished. On piece dyes it is well enough known that soap in the goods will produce clouds, but on cassimeres this is thought not to be of quite so much importance, but it is. At the washer a plentiful supply of warm water is of the utmost importance—not but that the process can be performed with a small amount or even without it altogether, but the results can in no case be compared with those where lots of warm water is readily at hand. When it is considered how easy it is to have a plentiful supply of warm water at command at any time, it is simply marvelous why more attempts at obtaining it are not made. It must be that the benefits to be derived from its use are underestimated. Of the many devices used for getting warm water there are none which will give as steady a flow of warm water whenever it is required, and no matter for how long a time, as the little device of which a small diagram is annexed. In order to have this contrivance work its best, let the supply water pipe be brought as high as the top of the washer and then bring a 2 or 2 1-2-inch pipe down on the side of the washer to within about 18 inches of the top of the bowl. To

the end of this pipe attach a 45-degree elbow and another piece of 2 or 2 1-2-inch pipe a foot long. Have this enter a coupling with a 45-degree elbow as shown in cut, marked "C." In the straight upper part of this coupling insert reducers, so that a one or three-quarter-inch steam pipe may be led to it, and from the under part continue with the same size pipe to the bowl of the washer and then put a 2 or 2 1-2-inch brass pipe across the whole width of the washer and have this pipe perforated with 1-4 or 3-8 inch holes 1 1-2 inches apart, with the holes turned toward the cloth in the washer or a trifle downward. It is best to have this on the side of the washer where the goods go down. Let both water and steam pipes be fitted with valves just above where they join and the job is done. To better understand the simplicity of its working, the diagram is annexed, wherein A is the water pipe, B the steam pipe, C the coupling and D a section of pipe inside of washer. By having the holes in the discharge pipe D only 1-4 or 3-8 inch in diameter the water is held back sufficiently to enable the steam to heat the water to the desired degree, which in no case should exceed 110 degrees F. This will make it possible to give the goods a generous supply of warm water whenever it is wanted, and after the pieces have been run into the washer and the gates have been closed, turn on the cold water first and then the steam, regulating both valves until the water is of the right temperature. When the washer is about half full of warm water, shut off both water and steam and let the pieces run a stated length of time. Now draw off the suds and again close the gates and repeat the operation. Before opening the gates to draw off the suds the second time, start the warm water running and then open the gates and leave them open.

When the pieces have run long enough, so that the soap does not show up any more, introduce the cold water gradually by lessening the amount of steam and after a while shut this off altogether and finish rinsing with cold water. As to the length of time required for the process it need only be stated that the first and second applications of warm water should last twenty minutes each and the final rinsing is usually accomplished in from three-quarters to one hour. This, of course, depends much upon the goods in hand, and is not subject to strict rules. At any rate, the pieces should show a good, rich lather after they have run about ten minutes in the first warm water, and if this does not show up, it is a sure indication that the vitality of the soap has become exhausted during the fulling and there-

fore has not been of sufficient body and the soap should at once receive attention and be made heavier before there is more trouble with unclean goods. But in order to get the set already in the washer clean it is advisable to use a good scouring liquor and even then it is often a question if the goods are as clean as they should be. By making the soap heavy enough in the first place, as stated before, this trouble will not occur, and on the rule that prevention is much better than cure, it is by all means the best plan to use only a good heavy-bodied fulling soap. So far we have not mentioned the strength of the soap, which is regulated by the amount of alkali put into it, for these things must in all cases be suited to the goods in hand. As alkali is quite an aid in the fulling, the temptation is great to use as much as possible of this, but this is not the best policy to pursue. Aside from the fact that alkali will affect colors more or less, it is well known that all soda products, no matter by what name they are known, will affect the wool fibre injuriously, making it harsh and brittle and therefore, for the best interest of the goods in hand, it is always advisable to keep the alkali in the soap as low as is consistent with the work required of it. This work is to loosen the grease and other foreign matter contained in the stock of which the goods are made, so that these may combine with the soap, to be held in suspension by it until the whole is removed in the washer. How much this amount should be depends upon the nature of the oil in the stock, the amount of it and how long it has been on the stock, for the longer it has been there the harder it will be to start it. These few things well remembered will go far toward producing a well-finished cloth. It should be mentioned, however, that the amount of soap put on the goods in the mill also has an important bearing on the subject. The goods must not be run too wet, nor yet too dry, although the latter will be found to be the most injurious, as it will needlessly wear the goods, and after being finished they will always look raw and open and worn out. To run them too wet usually brings its punishment with it, but aside from that the goods will never feel as solid as they should, being more sleazy and loose. Give soap enough so that after the goods have run about twenty minutes a test anywhere will reveal the soap by a moderate twist on the goods.

Next to the fulling and washing, the gigging or napping must engage our attention. The subject of napping, as well as the previous one, is large enough to merit the devotion of a

separate essay to it, and as this one is already of goodly size we will simply touch the most important points to be observed. First of all, it is important that the goods be perfectly smooth and free from wrinkles when they come to this process, and next, that they contain the proper amount of moisture. The work of raising the felted fibres must begin slowly and carefully, especially on face goods, where it is an object to save all the fibres possible. But on close-finished goods it will not do either to go too quickly, for if many fibres are pulled out in the process the finished goods will never look as good, even though they are shorn threadbare. The several threads will lack that roundness and plumpness which is such a desirable feature on well-finished cassimeres. Therefore let the work be begun with worn-out flats on the gig and a very slow speed on the workers of the napper, increasing either as the work progresses. As soon as all the felted fibres have been raised so that the threads of the fabric show clean and clear, stop the gigging or napping, for any more work will only tend to spoil that which has already been done. There is no use trying to obtain a nap from the thread and if all the felted fibres have been raised, the work is done, for no more can be gained.

At all the several processes observe carefully the value of neatness and cleanliness and when trouble arises do not trust to luck or guesswork, but set about at once to find the cause and see to it that this is made right. Guesswork may help a man once in a while if he happens to strike it right, but he is no better off, for the fountainhead has not been touched, and in the end he may find himself in a much worse predicament.

## WOOL CARDING.

### ESSAY NO. 18.

Without doubt carding is one of the most important and difficult departments to run in a woolen mill. No general rules can be given. Experience counts, but there are times when the best of us are put to our wits' ends to overcome some of the difficulties. We will suppose that the stock is all right as it leaves the dyehouse, though we know to our sorrow that often it is not. We will begin in the picking room. I think it pays to run all wool through the burring picker to

clean it of burrs, seeds, dirt, etc., and open the hard locks of wool. It leaves it more open and feathery than the mixing picker can.

After burring, make a bed of about 100 pounds in front of the picker. Sprinkle on oil, then another layer of wool, and so on until all is oiled, not forgetting to beat the oil well into each layer of wool with a stick. For a solid color once through the small picker is enough, but mixes should be run through twice. Every picker room ought to have a barrel with steam and water pipes in it. For one gallon of oil I take two of water and put in the barrel until I have enough for my batch; then I put in borax, soda ash or ammonia to mix with it and coarse wool. One gallon of oil is enough for finer wools. For fine yarns use plenty of oil, according to colors, condition of stock, etc. And now it is ready for the cards.

See that all lag bolts are tight. Set your engine lever with cylinder and at the same distance from shaft at each side. Finish with sandpaper. It is a good plan to give it a coat of oil, which will prevent it from springing when dry. Take some plaster and stop up all holes and cracks; space off and tack on sheets. I stretch my sheets about as tight as they will go, as I calculate not to do it again, though I have to, sometimes. For grinding I like a traverse best. Be sure and set it level with cylinder. Start lightly at first, and gradually a little harder, until finished. One day is not too long to grind a steel cylinder. You cannot hook the wire, unless you let it run too long, without setting closer.

If ground too hard, you will probably always be troubled with rough surface on wire. It is much better to be on the safe side, if it does take a little longer. This will apply to workers, doffers and strippers. In clothing fancy, wind it on snugly, but not too tightly. Set up to emery wheel pretty hard, and let it grind about twenty minutes. Take off belt, set into emery wheel, so that the friction will turn it, and let run backwards for fifteen minutes, and unless the wire is very uneven it will do good work and not wind. I prepare my old ones the same after picking up teeth. Put doffer fancy and stripper where they belong; belt, set, start up and let run awhile.

Go over again with the set. Put in your workers. Set first one off a little. For fine stock and mixes set the rest close so that they will run and not strike.

Some set the first as close as it will go, the next not too close, and so on toward the fancy, when it should be the other

way, to open wool and straighten it out gradually, and it will not be so hard on the clothing. The first worker always breaks out first, and some clothe it with coarser wire for that reason. The tumbler should be covered with 30 wire. Set up to cylinder, then burr cylinder as close as it will go and not strike; set feed rolls not so close. If a Bramwell feed is used, set top of apron even with top of bottom feed roll, and not more than one-quarter inch off, or short stock will drop under. Set the weight so as to make a good even feed, with no thin places. If roving is too heavy, put on small gear. After running an hour or so, examine your cylinder; if it does not carry too much wool and the roving is clear and free from specks, all is right. If not, your fancy is not doing its work properly; the belt slips, or it may be on too hard, or not enough. Be sure and have the work leave first breaker right; if not, you cannot make it so afterward. I have wools to make a mix of that no man could get the specks out of, if he put it through a dozen cards. In making a very dark mix the white ought to be of good pulled wool, as it is free of second clip or nibs. For a light mix have the block of pulled, and if the cards are in good shape, you will not hear the finisher grumble about specks.

What I have said about the first breaker applies equally well to the second, so we will pass on to the finisher. Clothing the ring doffers I consider should be most particularly done. First, if of iron, plaster up all the holes. Get them even and slip on the rings, and then set on your frames. Set collars up close to boxes on each side, to keep them from vibrating. Fasten your gauge with rest under centre. Have stick turned about 14 inches and of hard wood, wedge-shaped at one end, to about one-eighth of an inch thick. Put on belt and set. In this way you can get every ring in its place perfectly straight. Then get some store twine, run doffer more slowly, and wind on tightly up to surface of leather between each ring. Then cut your leather long enough to go around twice. Be sure and not cut it so wide as to crowd the teeth. Tack on with 12-ounce tacks. By filling up to within one-eighth of an inch of the point of the teeth, they strip better, and in cleaning, the teeth will not get knocked down or get bruised so badly. After picking up teeth, it is ready to grind. Put on lightly at first, and don't let run too long without setting up. Some will take longer than others, but they ought to grind until they are perfectly smooth. I generally put some oil on the flock brush and hold on a few minutes. Put in card; set up to cylinder; have

beveled board to fit between doffers spaced off the same as the gauge. Set and fasten your collars on each end of the shaft. Set strip roll nearly one-eighth of an inch from the doffer; your rub roll close enough to keep it from winding. Set rub rolls so that they will not quite touch each other. I like to set my finisher a little more open than my breaker, as I am more careful to keep it in good point, although I would rather have a smooth surface than a sharp one.

We will now go back to the tumbler. Set up to cylinder for leader-in (if for Apperly feed). I want it 3 1-2 to 4 inches in diameter to get well into feed rolls. Clothe it with 28 diamond point wire. Wind it on with the leather side up. Get a chalk line and three 3-4-inch space, pull out teeth, then wind on tight. Smooth up with emery cloth. Fill with picker grease. Set as close to tumbler as it will run and not strike. The bottom feed roll should be clothed with pretty coarse wire, or it will get bruised on the ends; the top with 28 wire set up to leader. Fill strip roll with grease; have it smooth, but not sharp, as I think it works better so. Now we will start up and run it a short time. Go over it again with set, and we will see what it will do.

It starts finely, rings all strip well, makes a nice round thread, and so far all is well. After running a while I weigh top and bottom spools, and find top quarter run too heavy. I set off top doffer, or change gear to drive top rub rolls faster or bottom more slowly. I always put top and bottom spools together and never have any fault found because they were not alike on all kinds of work. I have worked from one to 10-run yarn. On fine stock it is very easy; on coarse stock you may have to set off top doffer, and that is the stock that will bear it. It certainly is not half as hard to keep top and bottom alike as to keep the sides alike on the same spool. We will start up again. When the spools get full, I weigh the side threads and find they are fine, but the wide side of the feed is the finest. I lengthen out traverse belt, move lifting catch, and iron pulley the spike strap runs on. Start up again. The work is better, but not right. Then I notice that the drawing, as it is carried to traverse from overhead rig, is rather tight as it comes to each end of feed. I put on small gear and try again. It does not keep up with second breaker. I then take the roving from upright rod, remove the carrier rod, put in rivet so it will work up or down, take out set screw, and put in its place with collar to keep it on.

In place of the wire to support carrier, I put a wire spring, then fasten end of carrier rod to traverse with lace string, start up again and that is an improvement. Instead of drawing being tight at end of feed, it is tight in centre, if anywhere. I hope I have explained this to those who have not seen it. They can alter the rig if they wish to. This was on fine work, and it satisfied. At one time we started a batch of 2-run backing, mostly waste. The first two or three threads would come uneven and lumpy, and were fine on wide side of feed. I took out the wooden roller, next feed rolls, and turned it about one-half inch smaller on wide side for first band, and the next not so small, and so on to the end, tightened bands and did two jobs at once. My roping was of the right weight, and I had no more lumps. I have never been troubled with lumps or bunches on the narrow side of the feed.

Another cause of uneven yarn, where there is a spooler, is putting two large spools in second breaker at one time when they are about run down. Roping will be from 1-4 to 1-2 run coarser. A creel is better for even work, but having one large and one small spool, and keeping them so, will help. The Bramwell feed will not make even work if filled up and then allowed to run nearly empty. I have them kept about full. Putting too much waste in the feed will make fine threads. Have help make as little as possible, and feed a little at a time. The waste thread on the finisher is a nuisance, and for that reason some of the cards have waste blowers and there are no rolls dropping on the floor or coarse ends running on spools, and no waste, and we get much stock. For a remedy straighten up teeth on fancy, or, if worn short, put on new ones. Long teeth on cylinder or rings are almost always caused by grinding too hard. Too high speed will sometimes cause them, when obliged to run doffers very fast. Run your workers as slowly as you can. I am running doffers 22 turns, my workers hardly 4 for 5 1-2 runs warp, two-thirds, 4 white call, one-third card waste, with very few twits in it. Strip rolls running too fast or too slowly will do it. They ought to run a little faster than the surface of the rings. Sometimes, when bothered with twits, I have run my workers backward, and found it a great help. I think it is a good plan to run one backward on finishers at all times, but when stock is all right, I think the chief cause is in the doffer rings. In one mill I had four 48-inch finishers with 41 narrow rings on each doffer. We put all of our fine work on them. I don't know that I

heard a word about twits all the time I was there. In that case we could run doffers very slowly and get the production also.

I don't believe in grinding cards every time something is wrong. I have known of its being done three times in two weeks, but I want them smooth rather than sharp. After rings have run a few years, they stretch, when they are sure to make plenty of twits. Remedy, take them off, wind doffer with fillet, grind until all low spots are ground out, and then re-clothe it. It is better than press or any other paper, and not half so hard to slip on the rings. Doffers on fine stock, even, will make better work if not set very close to cylinder; try it.

In a card room look out for little things. When anything wants grinding, or fixing, do it at once. If put off until another time, you will probably have other work more urgent still, and instead of taking it coolly and easily, your work will always be driving you.

Keep your help contented and happy, if you can, and you will have more and better work.

## WOOLEN SPINNING.

### ESSAY NO. 19.

Any overseer can think of a thousand and one different things to help his work and to build up his room, but not one in a thousand puts his ideas into practical use. A theory is all right if a man can work it out, but, when he cannot, he should consult his fixer and talk it over with him. Time and time again spinners will go to their overseer and tell him that their work is going badly. They can't keep the ends up. The overseer will go and reel it, maybe, or finally he will let it out, giving the spinner more draft, and then walk away, when, if he would only stay in the mule alley for a few minutes, perhaps, he would find that the mule was not drawing right. And then again, when the spinner told him that his work was bad, he perhaps did not reel it, but let the roving out just the same. What is the result? If that yarn was heavy at first, it comes heavier now, and even if it was right at first, it comes heavy, anyhow. With heavy yarn the weaver cannot get his patterns to come right, just because the boss spinner did not

stop and find out whether that mule was drawing right. There are many boss spinners in this country who do this same thing every day. The writer of this article was a few years ago engaged to go to a mill where they were having a great deal of trouble in the spinning room. It was a medium-sized mill of about 12 sets, I believe. The first day I went to the town I got there at noontime, and after having my dinner I called at the mill office. The superintendent took me up in the spinning room. Well, I was disgusted with the sight. All over the floor was waste of every kind; bobbins were on the window sills and on the floor. I asked the superintendent if the work went badly. He said no; that the spinners ran the room and not the boss. I, of course, said nothing. We went all over the spinning room, and when going through the room I did not pay any attention to the drawing of the mules, as I knew that the spinners were watching me. After we got back in the office he asked me what I thought of it. "Well," I said, "it is all right if the spinners are running the room. But when I start in to work in the morning I am going to run it for a while and see how things come out." The next morning I started to work, and I noticed in particular that not one of them oiled his mule. I said nothing, but the second hand and I had a talk. I asked him if the spinners oiled up every morning. He said no; they only oiled up when they were obliged to, when the mule couldn't run any longer. Well, I said no more on the subject, but he and I took a walk around the different alleys. I felt of the way they were all drawing and I did not find one drawing anywhere near right. I did not do much that day but look around and change the draw on several of the machines, but the next day I started in. All the square shaft pulleys were full of waste. I cleaned them all off and lined up the mule, changed the draw, changed the wings on some and eased others up faster. The second hand said that the other man never used the ease-up motion on the floor and he did not know how to set it. After three weeks the spinners were taking off 25 per cent. more work.

One great fault with most of the boss spinners is seen, when, for instance, if a spinner tells him that his work is fine or heavy, he won't go to that machine, but runs to the card room and tells the carder. What is the result? Perhaps the carder is busy and has not got time to look over the card; so he just goes to the second breaker and takes out or puts in a creel spool. That work, if just right before, now becomes

either heavy or fine. I don't believe in going to the card room until I am obliged to, and then I believe in going until it is fixed. Spinners don't, as a rule, look out for their machines as they should; and it is one of the duties of the overseer to see that the mules are properly oiled every morning and the waste kept from off the square shaft pulleys. By doing this you will not have twits and fine places in the yarn, as you would have if the mule was being yanked in one end at a time. There is lots of work for the overseer if he will only do it, and not be thinking of pay day. Keep the mules and rolls perfectly even and you can make more uniform work. Have the spinners keep their waste from the carriage and oil up every morning, and the machines will run more easily. Don't take a spinner's word that his work is heavy or fine. Go to his mule and find out for yourself. Don't let the spinners pick out the reeling. Take it yourself. They know where the fine ends are. And another thing: Don't forget to reel every set of roving. Keep your help in their place; keep your room clean; keep your yarn even; keep your mind from pay day, and you can keep your job.

## KNITTING—IMPROVING THE QUALITY AND PRODUCTION OF YARN.

### ESSAY NO. 20.

I am employed as overseer of spinning by a concern in New York State. I entered their employ in February, 1905, as overseer of spinning. At the time I went to work for them there was a lot of trouble about the yarn in a number of different ways. At the time they were producing seven-pound merino underwear, making the yarn 10-grain, weighing 12 yards. They were not getting the proper production. It was running badly on the mule. The roving was all broken up; it was so bad that to fill these orders the firm was about to put a night force on and pay the spinners $2 a day instead of by piecework. Well, I have a friend on the road for a Boston dyehouse, who stops there and heard of the difficulty. He recommended me as a spinner, and I received a letter from the firm. I went on to see them and secured the position as

overseer of spinning, although they remarked that I seemed rather young. Well, I took charge.

When I stepped into that spinning room, and got a fair look around, I felt like getting out very quickly; but as I was ambitious to get to the top and this was my first big job and I did not want my friends to think I could not make it go, I made up my mind to stay.

The first day I just walked around the room to get familiar with it and to see just where I could start to better the thing. Well, 100 to 120 pounds of yarn from a 240-spindle mule was the average production. The second day I was there I went down to the carder and asked him how heavy he made the roving. He said 25 grains, weighing 20 yards. I said, "Let us put that up to 28 or 29 grains." "Oh," he said, "my boy, you can never handle it; we have tried that before."

Well, after a while I did persuade him to try it on one set, and we would see how it would go. Well, the result was surprising. It went finely. I took two holes of twist out, and the mule turned off 187 pounds of yarn that day. So in less than a week we had them all weighing 29 in the card room and I got two holes of twist out of every mule, and I must say that the overseer of knitting never knew that I took out twist. He told me it was the finest yarn he had ever knit. Well, it was a nice even round thread, with a better body than before, with all the twist. When they were making yarn from that roving weighing 25 grains, they had real tender stock; the roving was so fine that there was nothing to it, and it ran badly on the card; it was so tender that the spinner had to put twist in in order to make any kind of yarn, and the yarn was rough and bulky. Well, after we got to running smoothly and nicely, we put the production up 400 pounds a day, and up went my wages with the production. And the carder could not get over it. He said: "My boy, I have been here ten years, but my time was short if you had not come here. I had to keep it down to 25 grains, as the other spinner said it could not be run any heavier, although I thought it could."

Now, this is a very important part of a manufacturer's success, as all wise mill men are fully aware. A manufacturer, in order to be successful, must get the production; at least he has got to compete with other manufacturers; and if he is carrying more twist in his mules than is really necessary, his production is stopped right there.

There are too many overseers of spinning who have been

at the business for years, who, when they put the roving in the mule, if it does not run well, go down to the carder and get it made lighter, as they will say that it is too heavy, without even changing a gear, where, no doubt, they could have drafted the mule and spun that yarn to a better advantage all around, and with less twist. Of course, there is a limit to stretching yarn, but we want to get as near that limit as possible without injuring the yarn. And you will then find that you have better yarn and more of it; and less mending of holes in the cloth.

# WOOLEN AND WORSTED WEAVING.

## ESSAY NO. 21.

There is more to be taken into consideration in the weaving of woolen and worsted goods than one would at first imagine, as weaving covers a large field. There are, as we know, a large number of different weaves, some easy and others very hard, also a great difference in the goods. We have dress goods, women's wear, which, as a rule, are very light in weight. While some of these goods are easily made, there are others that are very difficult to make.

The main trouble is to get an even piece of goods. As there has been trouble in nearly every dress goods mill in the country over this one thing, I shall endeavor to give a few very good methods of how to procure an even piece of goods, either woolen or worsted. In the first place, if the weave is a twill weave, it will require very little weight on the beam. Even at the start of a full warp, there are not over eight pounds of weight on either side for a 16-cut warp. This will, no doubt, work very well for the first few cuts, but when half the warp is woven we find that nearly all the weights have been taken off, and should we continue to weave, we would have to take off one of the friction bands and run with only one band on one end of the beam only. Then comes our trouble. The loom starts to making uneven cloth, which is not noticeable on the loom, and probably will not be noticed until the goods are finished. To overcome this, take off the friction bands; in their stead, take a piece of heddle shaft; cut it the same length as the friction bands, then wrap them

with cloth and put them on the beam heads, the same as the friction bands. Be sure that plenty of graphite is put on the cloth band in under the friction band, and you will find that your uneven cloth has disappeared. The regular friction band, being 1 1-4 inches wide, puts on more friction than desired. The small 1-4-inch heddle shaft, used in its place, will allow one to put on four times the amount of weight, thereby allowing both bands to remain on the beam until the warp is out. This will enable you to keep the same amount of weight on either side of the beam, which ought to be done at all times. If you use more weight on one band than the other, it stands to reason that there will be more friction on that end of the beam. This will cause an uneven let-off, and an uneven let-off means uneven cloth. This is the reason why you cannot use the regular friction bands; as I stated before, if you did, you would have to take one off, when the beam got half empty, and when you did so, all the friction would be on one end of the beam, and cause it to let off in jerks or pulls. There are lots of other things which cause uneven cloth, but they are common things, such as the take-up gear slipping, or the sand roller not taking the cloth tightly enough, and allowing the same to slip, uneven filling, etc. Almost every one is acquainted with these and I shall not go into the minor details. Another thing that will cause uneven cloth, that very seldom happens, is the sand roller being warped or out of true. If the roll is not perfectly true itself, you cannot expect to make an even piece of cloth, no matter how hard you may try, for every time the large part of the roll came around, it would take up faster, causing less picks, which means light places. The third uncommon thing that causes uneven cloth is done by the dresser or warper. When he is beaming off the warp from the reel on to the beam he can cause uneven cloth by beaming the warp with uneven tension; if at one stage of the beaming he has the reel weighted tight and at the other loose, this will all show in the cloth; or if his reel, when beaming off, lets off in jerks or jumps, this will have a tendency to cause uneven cloth.

A lot depends on the dresser—more than one would think. I have worked in places where the cloth, when finished, showed streaks in the centre, also baggy, and when we have been making overplaids, the plaid, filling-ways, would not be straight, but be out two inches at either side. I have seen them do everything to the loom that anyone could think of.

Also, I have known the blame to be laid on the finisher. He has tried to rectify it on the dryer, by starting the cloth in on the slant, but it came out in the same old way. When the matter was traced back, it rested with the dresser. He would start with a full set of spools; the first few sections would be all right, but as the spools got lower, the weight got heavier; this would not reel at the same tension as at first, and here was the reason. We prevented this by having the dresser make the first section, then run his reel over and make the end section and fill in from either side. Our trouble ended here. Another place where uneven cloth can be caused is in the distribution of the filling. The very best way I have found (if the cloth to be woven calls for plain filling) is to run three shuttles in two boxes on each side. This will allow the shuttles to follow in rotation and will distribute the filling to the very best advantage. If the cloth is not plain filling, then run more than one shuttle on the dark colors. The overseer of weaving should attend to this, as it is left to him to turn out the cloth right, and if he is not around and ever on the alert, the fixer will naturally have the loom on as few shuttles as possible, as it makes it all the easier for him. Therefore I claim that a mill ought to have the very best of overseers, as it pays in the end.

In this article I shall consider an overseer's duties—how he should run his room to the best advantage; how he should handle his help, and how he should act in general himself. He should at all times consider the production and quality of the goods with the least possible expense, as we are aware that competition is so keen that the manufacturer is sometimes at his wits' ends to keep up. An overseer should always bear in mind that production is not everything, as there are plenty of mills to-day getting a large production, and yet they are not making near the money that other mills with a smaller production are making, both on the same class of goods. This does not seem reasonable, I know, yet it is so. Let us go into the details a little and I can then convince you as to my statements. In the first place, we will take the mill with the large production and the mill with the smaller production and compare them. We take it for granted that both mills are of the same size and on the same class of work. Dealing, as I am, with the question of weaving, I shall take the overseers of each weave room and point out where one loses, while the other gains. The overseer with the large

production does not watch his weavers as he should; he allows them to make too much waste. This is something which all weavers will do, if not checked. When a weaver makes unnecessary waste, it is a dead loss to the manufacturer, as this waste has to go back and go through the same process of pickering, carding and spinning that it did before. This is all a loss of time. It is not only doing the same work twice, but it is also causing poorer yarn, for every time a batch of waste is run over, it lessens the strength of the fibre. This is one place where No. 1 overseer is losing money for the firm, while No. 2, ever careful and watchful, prevents this and is saving money for his firm. Another place where No. 1 is losing is in not having a competent loom fixer under him, but one who allows the looms to run in any old way so long as they will run at all. A fixer of this class is a very expensive man to any mill, and it would be far better to get rid of him and secure a good man, even if you had to pay $2 or $3 per week more, for the firm would be in pocket in the long run, as a poor or careless fixer will use two or three times as much in supplies and repairs as a good one; also there will always be a discontentment among the weavers on his section, and this is one thing that should be avoided by all means. I believe in always having harmony and contentment among the help. No. 2 overseer avoids all this. He has a good fixer, a careful man, one who does his work right and needs very few repairs and creates good feeling with the weavers. This man probably gets a couple of dollars more than the other per week, but he saves more than that to the firm. I am aware that weavers are the same as any other class of help. There are some whom no one could get along with, no matter how he would try. In the third place, No. 1 overseer allows his weavers to run their looms without oiling them. In fact, he does not care how the loom or anything else is treated as long as he gets the production. This seems to be his only aim. Here is where he makes a fatal mistake, as no machine, whether a loom or not, will run and do its work satisfactorily without being well oiled, as it will only be a very short time when the loom will need a good many repairs that could have been avoided, had the loom been properly taken care of. No. 2 overseer attends to all this, as he is a competent man, one who understands his duty in every way. Here is where the firm again saves money. One would naturally think that the increased production would pay for all this. I will admit that

it helps to pay, but it does not pay all or one-half. One mill will probably believe in high speed, which has become the rage of late. Let me say that it is all well enough to have high speed, but do we stop to consider that there is a limit to the loom? Also, that it has a life, the same as a person, and that the faster it runs, the shorter the life? This high speed is done for production. It will increase it in some places over one-quarter, while it will decrease the loom's life one-half. Where is the gain? Take a person, and instead of his walking when he goes, let him run every time. Will it not shorten his life, the same as a loom? I believe I have pointed out clearly that production is not everything; also that it does not always pay. Now I will say just a few words regarding the duties of an overseer of weaving. See that your help are at work at the right time; also that they remain at their work and do not bother others, as is often the case. Do not try to be too strict. Rather drill your help into what you desire, and do not show them that you are trying to drive them. See that they turn off their work right. Prevent them from making unnecessary waste. See that your room and looms are kept clean and tidy and the looms well oiled; also see that your fixers attend to their duties properly and thoroughly understand their business. Don't allow them to ever have any words with the weavers, as you are there to settle all disputes, and, above all, act civilly toward your help, and use them as though they were respectable people and not slaves, and you will always have good success.

## WOOLEN AND WORSTED WEAVING.

### ESSAY NO. 23.

An overseer of weaving should be an A1 man in every respect, for more depends on the weave room than we think. There are two ways of running a room; one is the right way, the other the wrong way. There are ways of making poor yarns weave fairly well; also ways of making a good piece of cloth out of poor yarn. In order to do so, the overseer has to thoroughly understand his business.

An overseer's position is a hard one to fill rightly, and as a rule it takes a considerable length of time before a man can

attain this position. To be an A1 overseer of weaving, a man should first start at the low round of the ladder and move upward, round by round, according to his ability, being sure to thoroughly master the first round before advancing to the next. I am aware that there are mills which have poor overseers and some which have good. Those which have the poor are always having trouble in one way or another. A good overseer of weaving should also be a good practical loom fixer and ever be ready to come to a fixer's aid when desired.

Let us consider one thing that gives us one of the worst troubles on a loom and follow it through step by step and note the numerous causes and the remedies for it. This is a loom throwing a crooked shuttle. I will say here that every loom at one time or another is subject to this trouble, and sometimes it takes weeks to remedy it. The first principal cause of a crooked shuttle is in the picker itself. If the hole which the shuttle point hits is so deep that it causes the box to hang, even just a trifle, it will cause the next shuttle to be thrown crooked. The remedy is to cut the picker out.

Again, if the spindle hole in the picker is so large that it causes the picker to wabble, it will throw the shuttle crooked. Remedy: Take the picker off and replace with a new one.

Third, if the picker stick has worn the picker too much at the back, it will cause the picker to move sideways and throw the shuttle crooked. Remedy: Replace with a new picker.

Fourth, if the picker stick is worn where the picker strikes, it will give the picker an upward or downward movement which is not required and causes the shuttle either to fly out or throw crooked. Remedy: Cut the stick out if it will stand it; if not, put on new stick.

Fifth, the picker spindle being bent will cause trouble.

Sixth, the picker strap being too long allows the picker to come out too far in the box and causes the shuttles to hang on the picker.

Seventh, the bunter or check being back or forward too far will cause the shuttles to hang on the picker. Always bear in mind that anything that has the least tendency to cause the shuttles to hang will make the shuttle throw crooked.

Eighth, the binder or spring being bent too tight will cause the same trouble. There are different ways of bending a binder and I doubt if half the fixers to-day thoroughly under-

stand the different ways. There are certain ways for a binder to be bent on fast speed looms and certain ways to be bent on slow speed looms. As this subject would take an article in itself to explain, I shall not go farther into the details than to say—never have the binders or springs too tight.

Ninth, if the boxes are too low or too high, or if they are not bent on the right angle, both back and sideways, they will cause the shuttles to throw crooked.

Tenth, if the loom is picking too early, or if the shoe is set too far up in under the picking shaft, it will cause the same trouble, and also cause the shuttle to fly out. Very nearly everything that causes a shuttle to go crooked will cause the same to fly out. Therefore, if you get a loom that is throwing a crooked shuttle, look for causes for shuttles flying out, and nine times out of ten you will fix it all right, and vice versa if the shuttle is flying out.

Eleventh, if the race plate on the latter has become loose, or is uneven, it will cause crooked shuttles.

Twelfth, if the reed is bent out toward the face of the loom, forming what is termed a belly, it will cause it. Let me say that a reed bent in toward the back of loom will not cause it, as the shuttle has a tendency to hug the reed and wants to go back; so if your reed is giving you trouble, never bend it out; always bend in. The places that are already bent in, let remain; do not think for one moment that you can improve on them by bending them out; if you do, you will get yourself in hot water right off.

A reed is a very peculiar thing to set, and set right. Those who understand it have no trouble at all. A reed should never be set too far down, so it will be below the clamp. If so, it will bend in the wrong angle. After you have set it in the bottom clamp properly, do not pound down on the hand-rail, as I have seen a lot of fixers do. If you do, you will form a slight bend in the reed and cause nothing but the bottom of the back of the shuttle to touch, instead of the full back, and this will cause the shuttle to throw crooked. The hand-rail should be set on with its own weight, and never forced down, as it only acts as a support to the top of the reed. Also, have the reed come flush with the back shuttle guides on the race sword; if in too far, pack the hand-rail out with leather or paper.

Another thing that causes the shuttle to go crooked is the harness not being hung properly. Never allow more shade than need be, as it not only strains the yarn, but allows more

room for the shuttle to play. By this I do not mean to make such a small shade that the yarn will bind the shuttle and drive the power from it. Make the shade so as to give sufficient room and no more; also do not have the shade too high or too low, as each will cause the shuttle to be thrown crooked.

If the lathe is higher at one end than the other it will cause a crooked shuttle. All these remedies which I have given for a crooked shuttle will act for three things: First, a crooked shuttle; second, a shuttle flying out; third, an occasional weak pick. We have all been troubled with a weak pick, and have, no doubt, never found the cause. The whole cause is the shuttle going crooked. Stop this and you stop the weak pick.

## WOOLEN AND WORSTED WEAVING.

### ESSAY NO. 24.

In this article I shall endeavor to explain what causes filling to loop or kink, and how to prevent the same. In all classes of woolens and worsteds we are bothered occasionally with the filling kinking. Some fabrics are worse than others, as they have a different weave, and it is generally the weave that causes it. One of the hardest weaves for filling kinking is a 5-leaf, or 5-harness satin, on wool warp and wool filling. As this is considered the hardest, let us take it for an example. I shall point out, step by step, the way to prevent the filling kinking. First, see that the shuttles are well brushed. As a rule, most fixers, when brushing a shuttle, do not put any brush opposite the eye. Instead, they have two brushes just about a quarter of an inch below the eye, run in either from the sides or the bottom of the shuttle. Brushing this way allows any small knots or lumps that may be in the filling to pass through the eye and run into the cloth, and requires twice as much brush as it would if the brush were put opposite the eye. On the class of goods mentioned, the idea is to have the filling draw as tightly as it will stand, and by putting the brush opposite the eye you can get as much or as little tension as is desired. When the brush is inserted this way and the tension is not enough, all you have to do

is to turn the shuttle over and take a nail or anything that will fit the brush hole and knock the brush in a little. By doing this you bind the filling tighter, and vice versa, by the other method, you loosen the filling. The second thing that will cause filling to kink is the head motion being set late. If on a Knowles loom, to prevent filling kinking set the shell gears at least six teeth ahead and seven and a half if the loom will take it. On a Crompton loom set the head motion earlier, by loosening casting on the crank shaft and driving it forward. This will make your rocker move sooner. These are the two main things that cause filling to kink. After setting the loom early, if filling still kinks, we must look to the power on the picking sticks. Do not carry more than necessary. If the fault is caused by too much power, then the kinks will show on one side of the cloth only. When this is the case, take a portion of the power off the opposite side. A good many times I have seen the cloth weaving all right, free from kinks on either side, but just in the centre, at the stop-motion, it was looping. This will happen a great deal on worsted cloth. When the filling is looping at the stop-motion, three times out of five it is caused by too much power. You must find out which side has too much and take a portion off this side and your filling will stop looping. As I said, this will prevent it three times out of five. The other remedy is to lower the stop-motion just a trifle. The majority of fixers run the stop-motion too high at all times. The reason they do it is to keep the feeler wires straight, as they claim that by running a little lower the shuttle will strike the feeler wires and bend them. Whenever a shuttle does this you may depend on it that the loom is throwing a crooked shuttle. In previous articles I have given remedies how to prevent this. When setting the stop-motion to prevent filling from kinking or looping, set the feeler wires low enough so that the shuttle will just clear and no more; also set the shoe so the feelers will drop early, and if your power is all right you will never be bothered with filling looping by the stop-motion. Take a plain weave on worsteds and the filling will loop on worsteds and the filling will loop or kink at every knot that comes up in the warp. One cannot prevent this entirely. In some cases you can stop it altogether, but in others you cannot, although you may help it to a great extent. Take coarse worsted yarn, and it becomes a very difficult job, but by using good judgment you can stop it so that the cloth will

pass. I will go so far as to say that you take it all out, providing the knots do not have long tails left on them after tying; but where one of these comes up, it will either loop or float. In setting a loom for this class of work, set the head motion in the same position as previously stated; that is, early. Then, instead of running the head on the slow motion, set it on the fast motion, so as to have your harness close and open as quickly as possible. This gives a tendency to spring the threads apart, which it would not do if set on the slow motion. Also carry a wider shade on this class of work than on any other, and have the whip roller set down as low as it will go, as this makes the threads have a further lift. There are other remedies for kinking and looping, but they are common and I shall not go into details regarding them, as every one is, or ought to be, acquainted with them. I have pointed out the principal causes and know that they will work thoroughly. To set the head from slow to fast motions, if the loom is on slow, first throw the upright shaft out of gear, at the bottom; then loosen set screw on elliptical gear and turn it half-way around; set upright shaft back into gear; time boxes where you want them; tighten the screw in the elliptical gear—and your loom is changed from slow to fast.

## WOOLEN AND WORSTED FINISHING.

### ESSAY NO. 25.

An overseer of finishing (the same as any other overseer) has all he can attend to to keep up his end, as there are many things coming up daily that require his closest attention and all the knowledge and skill which he possesses to enable him to procure the finish which he desires. We are aware that there is more than one kind of finish for a fabric. Certain fabrics require a certain finish, some having what we term the steam finish, some the sad finish, while others must be finished for a soft feel and some for a hard feel. It all depends on the class of goods. One of the most difficult fabrics to be finished in woolens that I know of is a medium-grade Thibet. These goods require a very sad finish. First, take the goods when they come from the loom. Let

the percher mark all imperfections. Then let the burlers take and burl them. From there take to the menders and mend the worst imperfections. I will say here that as these goods are full, in both length and breadth, a good bit more than the ordinary class, they require very little burling and mending. I know of a ten-set mill running exclusively on Thibets with only three burlers and one mender. These goods are laid in the loom, all the way from 67 to 81 inches wide, and come to the finisher from 61 to 66 inches. After the burling and mending, take and tack both sides of cloth; about every six inches apart will be close enough, just to keep the selvedge from rolling. Then put in the fulling mill. Full them into the desired width and trap them up in length. The trapping is from 8 to 10 per cent., more usually 10 per cent. Use a good strong soap. Then take from fulling mill and scour thoroughly. Take out after you are certain that all the grease is out, and extract. Send to the dyer, if piece dyes; afterward bring back and speck dye them; then rinse them well and clear; extract and put them on the dryer. From the dryer take to the shear. Start shearing lightly and gradually come down a notch or two on each side, until you have them sheared as close as desired. Then press them. While pressing do not use the steam from the perforated pipe, as you are after a sad finish and not a glossy one. Use a medium amount of weight on your rolls—not too much; if you do, the goods will be too hard to the feel. Then measure, bolt up, ticket and ship.

Now I shall proceed to the finishing of fancy worsteds and we shall note where they differ from one another. The finishing of high-grade fancy worsteds requires close and careful attention. In order to get the best results, the goods must not be slighted in any of the different processes they are subjected to. Let us start at the first place and from there proceed. This is when the cloth comes from the loom. After being perched, measured and weighed, and all imperfections marked by the percher, it is then given to the burlers, the same as the woolen Thibet was. The burlers will look the goods over on both sides and raise the knots from the face to the back. At the same time pull off all hanging filling ends and all filling drawing in, should there be any. They are then passed on to the sewers, who will look them all over carefully, marking with chalk the imperfections that have been overlooked by the percher or burlers, should there be

any. Then they will sew in all that they have marked, such as ends out and mispicks, and attend to any imperfections that need mending. I will say here that this is a very important place, where the cloth should have the very closest attention. Nothing in the mending can be done any too well, and it often pays better to spend a little too much time than not enough, as this is the last overhauling which the goods get, and nothing should be left undone. A good many finishers have a mistaken idea that whatever is left undone in the burling and mending can easily be rectified in the finishing of the fabric. After the sewers are through with the piece, we come to the scouring.

After starting the pieces in the washer, add a few pails of thin scouring soap, enough to raise a lather, and in a short time you will soon see whether the grease has been thoroughly started. If it has not, add more soap; keep adding soap until it has been accomplished. Run in the soap about twenty to twenty-five minutes. Then add warm water for ten to fifteen minutes; open the gates and drain off. Afterward close the gates again and add one pail of soap to each piece, and run for ten minutes. Then again run in hot water and thin down the suds so that there will not be any left. Next add a bath of fuller's earth, two pails to the piece. Run about fifteen or twenty minutes and rinse well in cold water. Then take the pieces out and extract them. Then put them through the dryer at a good medium heat. After taking from the dryer, give the goods to the back burlers to remove all knots. Then put them on a pumicing machine to soften well before going to the shear.

When the goods are put on the shear, start them the same as the Thibet, lightly, putting the notches down slowly, about five runs, with the number always on the left. Then reverse right side and give about three runs. From the shear the goods pass to the percher, and after he has looked them over well, both back and face, they are given a light steam brushing. Then they proceed to the press. Be careful not to put too much weight on, as you will have a hard piece of goods, the same as the Thibet. Next, they are examined for shades and other imperfections, then measured, ticketed, cased and shipped. I will state that while I believe in using fuller's earth in the finishing of fancy high-grade worsteds, I do not believe in using it in the Thibets. A good many finishers do use it, but I have found that I get a better result by having

my goods come a little heavier from the loom. You would be surprised at the difference there is. Try it once and be convinced.

As I stated at the beginning, there are many difficulties cropping up almost daily and always unexpectedly. Take cockles, for instance. This is one thing that may not occur once in five years, and yet it is liable to happen at any time. The remedy for cockles is as follows: First, look to your soap and make sure that it is all right, as oftentimes the firm will experiment on cheaper grades of soap, and I have known the soap to cause cockles. If the trouble is not here, see if tacking the goods more closely, always with face side in, will stop it; if not, go to the weave room boss and ask him to trace the matter. Sometimes it is caused by the loom weaving uneven; again, it may be in the dressing, and also at times it will be found in the yarn itself being uneven. After these places are looked into, I am sure that you will not be bothered with cockles.

Another difficulty that very seldom happens, and when it does happen is one of the worst I know of, is the cloth having a very disagreeable smell after it is finished, and the longer it lies, the worse the smell. It mostly occurs on cotton warp goods with shoddy filling and sometimes happens with low-grade woolens. I once worked in a place where we were bothered with this, and as it was the first time I had ever had anything like it happen, I naturally thought that the trouble was in my soap being too weak. So I used a stronger soap. While it helped it a little, still it did not prevent the smell. I got my soap so strong that I was afraid of running the dye and I finally concluded that I could not overcome it in this way. I even went so far as to use coal oil. I knew that the oil would cut the grease and I had hopes that it would also destroy the smell; but no, it did not. I then traced the matter back to the picker room. I tested the oils which they were using and found them to be O. K., the same as they had always used. One thing that puzzled me more than anything else was that I noticed that one batch would come through all right and the other would have the smell attached to it. After studying and thinking for hours at a time, I came to the conclusion that the fault was in the stock. I went for the shoddy at once. The firm was getting two different kinds of shoddies from different companies. I took some of each of the shoddies, scoured them, and put them to dry, and I soon found

that one kind of shoddies had the smell, while the other was clear and all right. Then I knew where my fault was. The company that made the bad-smelling shoddy had no doubt used an inferior grade of oil. I reported this to the office. We got no more of that shoddy and our troubles ceased. I will say that these goods were not pulled. They were only scoured.

## WOOLEN AND WORSTED FINISHING

### ESSAY NO. 26.

In the finishing of woolen and worsted fabrics there are always some little things turning up that we least expect, and most generally it is these little things that cause the most trouble. A big thing is usually easily seen and while it takes a considerable length of time to fix it, we know that when it is fixed the trouble ceases; but where a little thing is giving trouble, it is sometimes days and weeks before we can find out what it is, much less fix it. If an overseer of finishing will stop and consider well before rushing in, headstrong, when these little things come up, he will save himself a lot of unnecessary time. As we are all endowed with brains, if put to use as they should be, we can overcome the greatest of difficulties.

There are, as we know, two classes of difficulties, one common, the other uncommon, and I take it for granted that it is the uncommon difficulties that we should try to enlighten each other about.

A short time ago I worked in a 15-set mill that was making woolen cassimeres. We had one range that gave us a lot of bother, and thought that it was in the finishing. The goods were black and white checks, on the order of the golf cloaking. The checks were two inches wide, both filling and warp ways. The first ten or twenty pieces came out very nicely. After that the black block seemed to draw up and show small ribs, similar to a concertina. The finisher, having the blame laid on him, tried every way imaginable to prevent it, but it was all in vain. After trying different soaps, also different kinds of finishes, he concluded that the fault must have been somewhere else, and reported it to the superintendent. After the

finisher had explained to the superintendent that the goods were finished the same as the sample, even making him stay and see one piece put through, he came to the conclusion that the fault was elsewhere. Then there was a general tracing back, from weave room to dressing, and so on, until they came to the picker room. Here is where they at last found the fault.

It appeared that the owner of the mill had never had any experience in the textile business, outside his own mill, and had never used shoddies, but had always made first-class woolen goods. A shoddy salesman came along one day and talked it into the owner that wool shoddy was the same as wool, and no one could detect the difference, once it got into the goods. He also pointed out the vast difference in the price, his shoddy being 21 cents per pound, and the wool at that time being 64 cents. The windup was that the owner ordered 2,000 or 3,000 pounds of black shoddy to try. When the shoddy arrived, he had it put away in the storehouse, unknown to the superintendent, and one day when this particular batch was laid, he had the picker man add in 25 per cent. shoddy. No one seemed to notice the difference until it reached the finishing. Then, naturally, the black, being the only color that had the shoddy in it, would not full as quickly as the all-wool; hence it left the concertina ribs. The way we finished these goods was as follows: After burling and mending, the goods were put in to full; we only fulled them in width. After being fulled to the desired width, we then scoured them, first in warm water, with four pails of thin liquid to the piece; then we opened the gates, drained off and ran them in cold water until thoroughly clean. Then we took them out and extracted them and put them on the napping machine and napped the back of them while wet, or just after we had extracted them. Then we put them through the dryer and from there to the shear; then they were pressed, bolted, cased and were ready for shipping. I will state that the reason why we napped them after extracting and not after drying was twofold: One reason was to make the nap cover better; the other was to make it lie right after it was dry. We had tried napping after drying and found that while we could get it right, it would not always lie the right way if it had the least bit too much handling, so we concluded to nap while damp, and found that it was just the idea. No matter

how we handled the cloth afterward it always kept the nap the way it was laid.

Another very bad thing I have noticed in goods was that after they were finished they came out full of spots, just as though someone had had oil on his fingers and had touched the goods here and there. This caused us a lot of trouble. It lasted for weeks before we found it out, as some of the pieces, I may say the majority of them, came out all right, and again one came that was spotted. By refinishing the piece it all came out, and seemed to be all right. We hunted high and low for this, trying our soap first, as I have seen this same thing caused by the soap; but it was not in the soap. We finally found that the rollers in the washer had all been worn so badly that they were almost of an egg shape, instead of being round. We took the rolls out, sent them to the carpenter, and had them turned down true; afterward we put them back in and ran again and our spotted pieces ceased to come. These two things I have mentioned very rarely occur, and had we used more brains than we did, they might have been overcome easily, for in both instances I believe I have clearly shown where some pieces were all right and a few were not; and we might have known from this that some little thing was causing the trouble and not our soap.

## FINISHING BLANKETS.

### ESSAY NO. 27.

Before putting our blankets in the fulling mill, there are several things to be considered or ascertained: The capacity of our soap tank; the strength and density of the soap; the number of inches in width and length, respectively, that our blankets must be shrunk.

There are several methods of determining the capacity of tanks. The following will be found to give results that will be near enough for all practical purposes.

Rule: For circular tanks multiply the square of the diameter in feet by the depth in feet, multiply this by 47, and divide the product by 8, and you will have the number of gallons. We will suppose that our tank is three feet in diam-

eter and four feet deep; then, 3 time 3 times 4 equals 36, and 36 times 47 divided by 8 equals 211 gallons.

We are now ready for making our soap. Fill tank half full of water and put in 75 pounds of good neutral soap, and boil for three or four hours, stirring occasionally to make sure that it will be all dissolved. Then put in 25 pounds of pure alkali; or, if you use sal soda, put in 68 pounds of that, as it takes about 2 3-4 ounces of sal soda to equal one ounce of pure alkali. Stir well, and when thoroughly dissolved fill up with cold water. Some finishers use more alkali than this, but if good wool oil is used and you have some delicate colors, you will find that this soap will give excellent results. On one or two occasions, when soda has run out, the writer has been reduced to the extremity of using caustic soda. But let me impress very forcibly upon the mind of the inexperienced user that this is a very risky alternative, and should never be adopted by anyone who has not a thorough knowledge of its effects and purposes. Whatever kind of alkali is used, care must be taken that there are no pieces of wood, nails, or other foreign substances intermixed with it or the consequences may be disastrous.

The soap should not be too warm when poured upon the goods, particularly where the colors are delicate. A good plan is to make the soap late in the day, so that it can stand over night, when it will be in excellent shape for using. This soap, if tested, should register about 2 degrees B.

We are now ready for our blankets. We first find out how much they should be fulled in width and length. Sometimes goods will reach the finisher in queer shape. The writer has frequently had blankets of the same style and weight vary as much as 24 and 28 inches in the length of the pairs from the looms. Therefore it is absolutely necessary to measure two or three blankets of every piece before running same into the mill. Now put on your trap or spindle such weights as are needed according to your judgment. Many finishers full two pieces side by side in the same mill. But in the opinion of the writer it is best to full one piece at a time, for the reason before mentioned, inasmuch as it gives the operator more control of the process by varying the weights to suit each piece. This is easily accomplished by running the piece in in two draughts. See that your shipper is in good working order. If it is not, get after it and fix it, as it is better to fix it now than to wait until there are several seconds made. Start up

the mill and pour on in a steady stream two cans of soap, if you do not happen to have a soaping machine, or a "lecker," as we used to call it in Yorkshire. This should be sufficient for a piece weighing 45 pounds, unless some of the stock has been dyed with extract of logwood, when it will require more soap. We always find it harder to raise the grease on this class of goods than most others. After the goods have run about five minutes, take them in the hand and squeeze them between the forefinger and the thumb nail, and if the fluid squeezed out has a saponified appearance, they are all right, but if the fluid is thin or watery, our soap has not body enough.

A good fulling soap should be alkaline enough to cut the grease in the goods thoroughly, and have body enough to carry the grease and soap in the form of an emulsion through the entire process. During the fulling process the goods should be repeatedly measured in width and length, and weight added or taken off as may be required.

When goods are fulled up to the required limit, we run them into the washer. Close gates and start up machine and run on warm water until they are thoroughly wet, and let run for about five minutes, when we will probably find that a good thick lather is forming; if so, let them go for ten or fifteen minutes. If not coming up good, give them a little more soap. After running for the above length of time, open top gates and run on warm water. Never let water get too hot; about 120 degrees or comfortably hand warm is about right. When the suds begin to assume a watery appearance shut off water and give about three quarts of soap to each piece. In a few minutes a beautiful white firm lather should be formed. Let them run in this for ten or fifteen minutes. Then open top gates and run on warm water again until all the soap is thoroughly rinsed out, and then give them lots of cold water for fifteen or twenty minutes, when your goods will be perfectly clean.

Take out and extract, not too dry, nor yet too wet; if too dry, the fibres are harder to raise, and if too wet, the nap will lie too flat. To finish well, they should be just damp enough so that the flocks won't fly too freely.

In napping it is well not to have too much tension on blankets. We find it a good plan to let the goods hug the cylinder pretty well, and have the tension just sufficiently strong to prevent the piece from sagging while traversing the

overhead carrier rolls. Arrange the napping energy so as to obtain a good full, lofty nap, with web well covered, when goods have had three runs, back and face.

If there are any defective places in the napper rolls, where wire has broken off, by moving the goods a little to one side from time to time an even nap will be produced.

The goods are now ready for drying, brushing, hemming and packing.

Where bleaching is practiced, it is, of course, necessary that they be bleached before being dried.

If bleached by the sulphur process the goods should not be overcrowded or they will come out streaky, and for another reason which I shall mention presently.

About three-quarters of a pound of sulphur to the piece will be plenty to give good results. Speaking of overcrowding, the writer remembers having considerable trouble from this cause one time. We had a big run on white blankets, all cotton warp. During a spell of hot, moist weather, nearly every morning, when the goods were taken out of the bleach house, we noticed a number of brownish-looking spots. On tasting those spots we found that they tasted very strongly of acid. Where had it come from? The superintendent said that we must have been very careless in handling the sulphuric acid, which, by the way, I neglected to mention, we put on the goods just before taking out of washer, about one and one-half pounds in five or six pails of water. We knew that we had been careful enough and that we had not spilled acid on those goods. When those goods were dried and napped, those brown spots would become more holey than righteous, and the righteousness of the super evaporated proportionately as the seconds accumulated day after day. Finally, in sheer desperation, we went to the bleach house early one morning, and on looking in there, lo! we found the cause of all our troubles. The goods had been crowded, and the last ones put in had been dripping wet, and all these things, combined with the heat from the burning sulphur and hot, moist atmosphere, had formed a vapor, which had condensed on the ceiling in the form of drops of water; these dripping down had caused all our trouble. On tasting these drops they were found to be intensely acid. It is needless to say that there was joy in the camp.

# WOOLEN CARDING.

## ESSAY NO. 28.

A practical carder must have years of experience, as his position is one of the most particular to fill in the mill. I believe there are more little (as well as large) things in the card room to contend with than in any other room in the mill. We know that the carder is held responsible for the yarn. If it does not spin as the boss spinner thinks it should, he goes to the carder. If the yarn does not weave right, it is more often left to the carder to attend to than to the spinner.

The first and main thing we should take into consideration is the help. We should have help whom we can rely on; also help that thoroughly understand their different positions, as no card room can be run successfully without efficient help, no matter how good a man the carder is himself. Very often have I seen cases where the carder had to be always putting small boys and inexperienced help on. I will say that the carder did not do it of his own accord, but was compelled to, as he could not get good help for the wages. Some superintendents and manufacturers seem to think that any kind of help is all that is required in the card room, and then look to the carder for good results. A carder, in order to get good yarn from his cards, also should have good help. He should know what stock a lot or a batch has in it, so as to enable him to set his cards accordingly. I think it is a very good idea to let the carder have charge of the picker room; then he will know exactly what stock is being used. He can prepare it according to his own ideas and set his cards to receive the same; then, if poor yarn comes, he will have no excuses, whereas he would have excuses if he did not know what the stock was, or how it was prepared. When a carder has charge of the picker room, if he has a batch that he thinks will not run, it is his duty to report the same then and not wait until it gets on the card, for after it reaches the cards it is too late to say anything.

In preparing a batch in the picker room for the cards we should first consider the nature or grade of our stock; if it is coarse, then see that plenty of oil and water is used, about one-third oil and two-thirds water. Boil or heat them together and add a little soda ash. If the stock is fine, use less oil and water. The amount of oil and water to be used differs

according to the opinions of different carders. I do not believe in soaking the stock, nor do I believe in having too little used. The proper way is just to give the stock enough moisture to carry it through the carding and spinning nicely. Some carders make a great mistake by putting too little on. They use only enough to carry the stock through their cards, and do not take into consideration the spinning. The consequence is that the stock spins badly where it ought to spin well. By putting too much oil and water on, you are only making more work for yourself, as it will help to gum the cards and cause them to be cleaned too often.

I once worked in a place where they stripped the first breaker twice a day, on account of its being so choked up that it would not run. After I was there a few days I had this stopped. Nothing was the matter, only, the stock being shoddy, the previous boss had used too much oil on it. After I was there three days I had the first breaker run two days without stripping on the same grade of stock.

In preparing the stock, be sure that you run the wool through the burr picker, even if you think it does not need it, for running through the burr picker will help to open it out, besides taking out all dirt and burrs. Afterward put in layers behind the mixing picker. Give each layer oil and water; beat in well with a stick; add another layer of oil and water; beat with stick, and so on until batch is all laid. Then run through picker at least twice, and if it is a difficult mix, three times will not hurt it. Don't depend on your cards to do all the work, as you have pickers to aid you.

Now we are ready to card. Fill your feed box and always try to keep it as nearly full as possible, all during the batch, as a low feed box means uneven yarn. Set the first worker a little farther away than the second, and the second farther than the third, and so on till you come to the last, as this will give your stock more chance to card and save your points. Then, if you should set all workers the same gauge, as most carders do, set the second breaker the same as the first. Do not feed too heavily, as this makes the finisher do too much, and does not give an even yarn. Keep your cards ground smooth—not too sharp—and you will have good results. This will in most cases overcome twitty yarn, if workers are set right. Some carders run one worker and sometimes two backward, to prevent twits, but I have always managed to overcome them without this.

Try and keep contentment among your help and make them feel satisfied if you can. Also keep a good clean room, and at least once a day go up into the spinning room and note how your roving is spinning. Sometimes it helps a great deal. You may see where you can better it, whereas you will not if you remain in your own room.

Regarding grinding, I will say that this is one of the most particular jobs in a card room, and if in a large card room, one man ought to have charge of grinding and setting alone. In grinding a cylinder, start grinder lightly. Never grind too hard. You may think you are gaining time, but you will lose in the end. Set light at start; then gradually harder. A cylinder should be ground at least one full day. This same way of grinding applies to the doffers, strippers and workers. Do not grind too often—only when needed. Keep the points smooth and not too sharp and you will overcome a lot of difficulties.

## COTTON SPINNING.

### ESSAY NO. 29.

In considering cotton spinning from an overseer's point of view, we will take it for granted that the roving comes from the carding department in good condition. For many overseers lay all their trouble to the roving, when a great many times, if they used as much energy in looking after their own work as they do in finding fault with the carder, they would get along better.

It should be the aim of every spinner to put every bobbin of yarn into the spooling in as strong a condition as possible, for warp yarn is just as strong as the weakest thread in the warp at the loom. It is impossible to produce yarn that will weave well where the work does not run well in the spinning room. If I was to pass judgment on the quality of yarn which a spinning room was producing, I would rather see the condition of the room itself than see a few bobbins of yarn tested on the breaker. My argument is this: If the work is running well, the yarn produced must be of good quality. Therefore it is the duty of the overseer of spinning to see that his work runs well, and he will then find that most of his troubles are over.

Let us consider some of the things that will help him in this respect. One of the most important is the rolls. The top rolls should be in good condition and set not too far apart; the distance between the centre of the front and middle rolls should be a sixteenth of an inch shorter than the staple. If you have them set too close the yarn will show it very quickly, by being bunchy or cockley, as it is called. In that case they should be opened a little. Great care should be taken that the rolls are properly oiled, as the help in the spinning room are young and apt to neglect them if they are not looked after very closely. And right here I advocate something to which many spinners may not agree. In arranging the draft of the rolls, I believe there should be at least two teeth of draft between the middle and back rolls, and in case of a long draft there should be three teeth. It has been my experience that stronger yarn will be produced by drawing, for example, three inches between the back and middle rolls, and seven inches between the middle and front (total draft 10 inches), than by drawing one and one-half inches between the back and middle rolls and eight and one-half inches between the middle and front. But where the total draft is not over six and one-half or seven inches, I would not advocate much draft between the back and middle rolls. And right here is a point that I have proven to my own satisfaction. In different mills you must take conditions as you find them. I am aware that a spinner will try to get as short a draft as possible, but I disagree with him a little. Let us suppose that a spinner is called to get 28s yarn from 1 1-8 inch stock, and in carding you are obliged to have one hank roving doubled in the back at the fly frame. I believe you can get stronger yarn from three-hank roving with a 9-inch draft on the spinning frame than you can by obliging the carder to draw his fly frame roving to a four-hank and draw 7 inches on the spinning frame.

Another important point in spinning is the spindle. It must be set in the exact centre of the ring, not only at the top, but it must be plumb, and the girdle wire must be set at the same time. The spindles must be oiled often enough to insure them from running dry and the only way an overseer can be certain that they are not running dry is to inspect them himself.

The bands are also an important factor. While I am aware that tight bands mean a waste of power, my experience of twenty years in the spinning room demonstrates to me that there is a great deal more money lost from slack than from

tight bands. I believe that spindle bands should be put on by a well-paid man, and not by a cheap boy. Slack bands mean soft and weak yarn and bad running work at all times, while tight bands after a day or two will regulate themselves. Several times in my experience I have taken a room that was producing a good deal of soft yarn and going very badly, and by simply rebanding the spindles I have stopped the production of soft yarn and have taken out two teeth of twist, and still the work ran better than before banding.

A spinner must also be careful of the travelers. One number heavy or light will throw the best-regulated spinning room into confusion. There is no rule that a spinner can follow, for conditions change in different mills and often in different rooms in the same mills. For instance, if in going around the room on a certain kind of work you find that the majority of the ends break down when the ring rail is at the top of the bobbin, and while the bobbins are small, the conclusion is that the traveler is too heavy. If, on the other hand, the greatest breakage of ends occurs when the bobbins are full, or rather just before doffing, and a large number of travelers break off, the conclusion is that the traveler is too light.

While many spinners may have a different opinion, I believe in running as light a traveler as possible and in winding a good hard bobbin.

And now a word in regard to production. While it is important to produce a good strand of yarn in these days of speed, it is also necessary to produce as much as possible. While I believe in speed to a certain extent, I think that some spinners go too far in that direction. It takes very few ends down to take off the production of a spinning frame, so for that reason there is nothing gained by too much speed. There are other ways of pushing besides speeding up. It is amusing to see a second hand hurrying to get a broken-down frame started while around the room there are enough dead spindles or back ends to count up to two or three frames. Keep every spindle spinning yarn and the breakdowns will come out all right.

The doffing is a place where much yarn is lost. The doffers should not be allowed at any time to have more than two frames stopped, and, if possible, but one.

To sum up, an overseer should at all times be careful of small things. See that the frames are in good condition and are kept cleaned and oiled. See that the men are kept busy,

for a spinning room was never at any time well run where there was nothing to do.

## WORSTED FINISHING.

### ESSAY NO. 30.

One way of keeping track of the work that comes into the finishing room is to have a stock book. This book contains a space for each style and range. When the cuts are given out to the burlers, the piece numbers are entered in the book under their respective styles, and when the goods are finished the piece numbers are checked off. It makes an easy method to find a cut when wanted in a hurry.

The first thing to be done to the cut is to have the style, piece number, loom yards and loom weight sewed on one end of cut, also the number of the burler who burls the cut. Burling must be done carefully. All knots should be raised to the back. The cut is next taken by an inspector and pulled over a flat top table and all imperfections that need fixing should be marked with white chalk, so that they will be easily seen by the sewers. After the sewers are through, the cut is taken to a perch and perched to make sure that everything is all right.

Washing is the next process. The washer should have two pairs of guide or ring boards. The first board is placed directly in front of the rolls and the other board is laid flat in the space between the washer frame and sud box. Have two sets of boards with different size rings for heavy and light weights; also have an extra outlet for the water. Have it between the gate for the sud box and the bottom gate. By arranging it this way the bottom gates can be kept closed, and then there will always be enough water for the goods to float in, there is a greater chance for the cloth to open out and new folds go through the washer rolls. The more open the cloth is during washing, the less chance there is for washer marks.

The soap will have to depend on the amount and quality of the oils that are used. The thing is to have a scouring soap that will overcome the grease or oil. One way is to make the soap strong enough so that it can be thinned down before using. Have a large barrel or tank piped into the washer.

Mix up the water and soap in this tank and then let it run into the washer. I think that it is best to use cold soap, and the water used to loosen the soap should not be hot, but just warm enough to take the chill off. After the first washing is done, give the goods another light scouring and this will make it a sure job. It is best to take a little extra pains here and have the goods as clean as possible. It will pay in the long run. Extract thoroughly and dry at a moderate heat. The goods are now ready for back burling. After back burling give two or three runs on steam brush with steam. The steam will help soften up the fibres. The shearing comes next, and it must be done carefully and well. Put them on face up; give three or four runs. This cuts off the ends which the sewers have left; reverse to back and give two runs. Next is the specking, and after the specking put the goods back on the shear for a final shearing, which should be the reverse of the first shearing; this time they are cut close. Bring the blades down gradually, and just close enough so that a piece of tissue paper can go between the cloth and blades and not be cut up. After this shearing, the goods are taken to the perch, looked over and any places that need sewing are marked for the finish or clean sewers. After that give one run on brush; press at a moderate pressure and roll up on a roll. Let the rolls lie over until the next day, to cool off. Next come the final perching, measuring, rolling up and ticketing.

## FINISHING WOOLENS AND WORSTEDS.

### ESSAY NO. 31.

In finishing we have to adapt our ideas to the machinery we find at hand, therefore we cannot lay down any hard and fast rules to follow, as some mills have up-to-date machinery, while others have their machinery worn out and only fit for the scrap heap. So when in a position at any kind of a mill, do the best in your power to bring about good results by a careful study of the machinery at hand. Finishing consists of wet and dry; also preliminary operations, such as burling, mending, etc.

Take pieces from the loom; have them perched and measured, and have fines for bad weaving, etc.; then take the last

end woven, put on the number of piece, style and weight per yard; sew on neatly on the face. Next, on woolen goods, comes fulling.

Fulling is accomplished by the aid of moisture, heat and friction. The rotary fulling mill has all the appliances for the same, as the soap we use causes moisture and heat is generated by the friction of goods running in rotary motion. As a rule, goods come from the loom weighing more than the finished weight wanted; we find that they sustain a loss varying from 15 per cent. to 30 per cent., in some cases, by waste removed, dyestuff, oil, dirt, etc. So before we proceed to full, we should know what we have to shrink before we put the goods in the mill.

Example: A piece of goods from the loom weighs 18 ounces; the finished weight is 16 ounces. There is 20 per cent. loss in dyestuffs, oils, etc.; 18 ounces, with 20 per cent. loss, equals 14.40 ounces, times 36 inches equals 51,840; divided by 16 ounces wanted equals 3,240; taken from 3,600 inches equals 3.60 or 3 3-4 inches to be fulled per yard to finish 16 ounces. Put the pieces in the mill; now knowing what the end is to be, sew together with fine sewing; start up; put on your soap cold at the front of mill while running; pour on slowly; put on enough to wet even; let run ten minutes. Now examine to see if the pieces are wet enough, the object being to get an even wetness all through; if not enough, give a little more; go slowly, as too much is really worse than too little, as it causes them to slip under rollers and nip three-cornered holes. That is a trademark for having goods too wet, and also it gives them a sleazy and flat feel. Adjust your traps on shrinking forces so as to be working all through the fulling and shrink in length in proportion as width goes; if you have to full up 8 to 10 inches in width and 3 3-4 per yard, well, to every three inches in width full one inch in length. By so doing we get a much better felt and better feeling piece of goods. Also overhaul several times, and before taking out of mill, give another pail of soap to keep up life of soap; then, when in the washer, application after application of warm water will bring up a good white lather. Let your first dirty suds off; then let raise for twenty minutes. Now rinse in warm water one hour; 20 to 30 minutes in cold; take out and the goods will be all right. In scouring fancy worsteds first soap 30 minutes; rinse three-quarters of an hour in warm water; then give second soaping for 30 minutes. What is wanted now is a thick

white lather to break off in chunks. Then run one hour in warm water and twenty minutes in cold and the goods will come out all right. A few words about piece dyes. We must get up good suds, creamy, and run for 35 minutes, and give as much rinsing in warm water as time will permit; finish in cold 20 minutes; take out and be careful to keep clean. Lots of spots on light blue piece dyes are caused by taking goods out of the washer with dirty hands and letting them touch things before dyeing. After dyeing, always wash off in fuller's earth; give 25 pounds to a barrel of water; put in washer; run 20 minutes; rinse off one hour in cold water; they will look and feel better for treatment.

Shearing is one of the most important things in bringing good results. Always keep the machine in good condition and have it run easily. Never allow your blades to rattle and in shearing always commence with a light cut and come down gradually on your set. By so doing you get better results, and keep your machine in better condition. The shear is a poor place to crowd the goods; if you do crowd here, you do it at the expense of the machine. When the shearing is done, have the goods specked. Keep burling irons in good shape. From here take to the remenders if necessary. Then pass on to the steam brush; give one run with a little steam. Now pass on to the dewing machine. From here put the goods on the rotary press. Give a moderately hard press. Let them roll up on the back of the press and stand all night. Then unroll and on the goods that want a velvety handle steam off lightly; then examine for imperfections that need an allowance; string the same; then roll up neatly and ship to destination, wherever it may be.

Neatness counts. Use a good soap. Give as much time in warm water as possible; not hot. Have your fulling soap of a heavy body, with enough alkali to start the grease, as an excess is detrimental to colors, etc. A general rule is 7 to 8 ounces of soap to 3 to 4 ounces of alkali per gallon. Do not take what I have written as the only way, as there are many others, and on some goods we could cut down the scouring of fancy worsteds one-half, as we all know that stock varies, and that is what governs us in finishing. Then on goods which have cotton in them, our advice is to soften in the dry state. We have sanding machines that are very good, but most finishers have some way of their own. I myself have dry

fulled them after drying and then given them a good sanding and whalebone brushing.

Have a good system and keep things clean. Instruct your help in the habits of neatness, and by close observation of above and practice, you will have the pieces finished to perfection.

## WOOLEN SPINNING.

### ESSAY NO. 32.

An overseer of spinning is, without doubt, one of the most important factors among overseers, as it depends mostly on him to get good yarn. The weavers cannot make good cloth if the yarn is not spun right, nor can they get good production if the bobbins are not wound right. There are more duties for an overseer of spinning to perform than to keep his room clean. He should always be around in the mule alleys to watch for any troubles that are liable to turn up. Many a boss spinner has an idea that as long as the mules are running, that is all that is required of him. This is where he makes a great mistake. He is hired by the company to look after the room and to run it to the best advantage; to turn off good work and to keep the machines well cared for. He should see that the mules are well oiled every morning. Do not let them run until they won't run any longer without oil, as the spinners will let them do, if not watched. Keep your rim bands, also spindle bands and square shaft pulleys, free from waste, as this will cause twitty and faulty yarn. Don't try to run with too much weight on your fallers, when it is the shoe that needs adjusting. Keep the faller wires medium tight, so as to have your bobbins built alike. Keep the tension on your spindle bands the same, so as to prevent soft bobbins. Soft bobbins are not always caused by the spindle band being loose. They can be caused by the carder not making the spools right. If you have a spool with fine ends here and there, you are sure to have soft bobbins, and all the tightening of the bands that you could do would not make any difference. A case of this kind should be reported to the carder at once. I don't believe in running to the carder for every little thing that goes wrong, but wait and see if the fault is really in the

card room, before I go. If your stock runs badly and you think you can improve on it by a little less draw, go to the carder and have him make a set of spools for the mule and try them. I know that most of the places try to draw more than the yarn will stand. This is done principally to help the carder along; but where is the sense of the carder filling the racks with spools, when the stock runs so badly that you cannot keep up to him, whereas, if you made the carder give you a little lighter roving, you could get better yarn and quicker results. All these little points should be studied out before going too far. Always reel and weigh each set of roving, and make sure of it. Don't ever rely on others. See that your mules are fixed right. Never allow one to run when out of order. I have seen mules running which, when they went in, would bang and pull in unevenly and come out in jerks. You can't expect roving to spin well when the mule is running in this way.

A good many boss spinners run the mules without using the ease-off motion. Why, I do not know, but they do it, nevertheless. The ease-off motion was put on a mule for the purpose of easing up on the yarn while spinning, and is of as much value as the scroll band itself, and when it is not in use you cannot expect roving to spin well. The very best of stock will not run well without the ease-off motion. Every spinner has at one time or other made bands for the spindles on the old-fashioned style band machine. When twisting these bands up, you could not hold them out to the same length as they were before twisting; you had to ease in on them gradually, according to the amount of twist you put into the band. This is precisely the same purpose that the ease-off motion should be used for. The more twist you put in the yarn, the more the ease-off.

There are lots of things that an overseer could do to make the work run well, if he would only try, but, as a rule, all that some care for is to sit down from morning till night, and when disturbed they get cranky. An overseer of spinning should be a good mule fixer. He should understand thoroughly every part of the machine, so as to be able to set it right. I know that very seldom are there two who fix alike, yet we all have what we consider the best ideas. Let us put these ideas into use and not keep them in our minds, and see if we cannot improve the conditions. Don't be satisfied if the mules are running; instead, watch the machine, and where you know you

can improve, do not hesitate to do so. If you have a second hand, talk the matter over with him. Tell him just what you want done, and let him carry out your instructions. Be sure that your second hand is a man you can rely on. If not, then change and get one that you can depend on. A good second hand is a big help, and between you the room ought to be kept up to its proper shape. See that the help obey orders and attend to their work as they should. Train them to be punctual at starting time; also to be as neat and as tidy as they can about their work. Be sure and insist on good piecing, and don't let them piece up an end when the carriage is all the way out, for you know that just as sure as they do, it will be sure to break apart in the loom; remember that part of your reputation depends on the way the yarn runs in the weave room. It is not always the quantity you turn off, but most generally the quality. Carry out these few hints and I am sure that you will meet with success wherever you go.

## COTTON SPINNING.

### ESSAY NO. 33.

I will say that when roving comes from the carding room in good condition, as is the rule in a well-regulated mill, it should be the aim of every spinner to make as good, clean and strong work as possible. It is better to have the roving creeled on a line with the rolls if you have to run two rows, because where they are drawn over a rod from a top creel it has a tendency to strain and weaken it; and it should be given about two teeth draft between the back and middle rolls in case of a long draft, and about two inches in a total draft of 10, and 8 between middle and front rolls, but in case of less draft there should be less between back and middle rolls. Leaving the draft here, we will consider the spinners. They should not be allowed to run more sides than they can handle and do their work as it should be done.

Keep frames clean, and oiled, and allow plenty of time, in doing it, to do it rightly. Top rolls should be oiled in the morning and steel rolls oiled twice daily, and if you have oilers, as they do in most mills, see that spindles are oiled regularly—usually every two weeks for the late improved spindle—

and cylinders, studs, intermediate gears and all parts that are revolving quickly, oiled twice a day, and every part of the frame wiped off and cleaned at least once a day, and in mills with very coarse yarn as many times as four, or even more. All of this has something to do with making strong yarn. Then the top rolls should be gone over once a month by the second hand to see that every one is in good shape and producing good yarn. Then we follow the yarn through the frame. The thread board guides should be in proper place and inside wire set directly over the centre of the spindle; and the spindle should be true with the ring; if not, in either case it will produce strained and weak places in the yarn. Both should be set with great care, the travelers renewed as often as once a month, and bobbins looked after; and see that there is no roughness or splinters and that they are not damaged in any way at the top, so that the yarn will catch and draw through, as that will produce weak yarn.

Never allow spinners to put oil on rings, as it gums them up and causes the traveler to draw hard, which produces weak places in the yarn, and also spoils the rings, by the friction of the traveler, which causes the temper to be taken out of the rings in some places and puts it in in other places. This knowledge comes from my experience as a frame spinner for twenty-three years. I have worked in several mills where they oiled rings, and I find that they wear out three to one, compared with those that are not oiled. In one mill, especially, when I went there, they did not allow it. At the time I was spinning there the rings were in good condition. It was seldom possible to find one that was bad. They changed the boss spinner, and the new man allowed them to oil the rings, and in three months they kept one man putting in new rings to keep the spindles from being idle. Shortly after, they changed overseers again, and a stop was put to it; and in less time than it took to get them in bad shape, the new overseer had them running as the first boss did. The trouble was caused by the traveler having more friction in some places than in others; and also sometimes the temper in the rings would vary, as they were not tempered evenly; the friction of the traveler and oil finds the soft places and also helps to make hard places in the rings harder.

Yarns should be wound on the bobbins smoothly and firmly. The traverse should not be too long; usually allowing three-quarters of an inch at top and bottom will do away with

tangled bobbins. Have the builder motion take the proper pick so as to allow the bobbin to build with the right taper, not too steep or too blunt. If bands are put on too tightly, it will cause the frame to run hard, with a consequent loss of production; if too loose, it causes slack yarn; therefore, they should be put on by an old and experienced hand and be tested by the same hand—not necessarily every morning, as in some mills, but every time there is a damp spell and then it come off dry; then is the time that bands slacken. In case of a dry spell and no rain, they should be tested once a month.

If ends run badly and the yarn is not running lightly, and there is no cause for it in the roving, look at the top rolls, steel rolls, traveler rings, and thread board guide; in most cases, where fine yarn is being spun, you will find it in the top roll, where it has become channeled, and quite often in the middle roll, as the middle roll holds the fixers, while the front roll draws them. Sometimes the middle roll slackens in speed, caused by friction on the ends; where the room is kept very hot, the ends will expand to a certain extent and on most frames will cause friction on cap bars; sometimes top clearers are not covered properly and securely and will come in contact with the middle roll and cause it to stop, and this produces weak yarn.

Most overseers prefer boys to doff, but I prefer young men grown, with some ambition for something better for the future, as they will work harder to keep the frames running. This is the place to put the best help you have got, as the production depends on the frames running every minute possible, with no dead spindles. Overseers should figure on how much yarn there is lost on a frame stopped for one or more minutes. For example, suppose you had a frame with a front roll speed of 122, roll one inch in diameter; 3.1416x122 equals 383.2752 inches in one minute, or 388.2752 divided by 36 equals 10.6465 yards in one minute, of one spindle; if frame had 208 spindles, 10.6465x 208 equals 2,214.472 yards for one frame.

## FINISHING OF BROADCLOTH.

### ESSAY NO. 34.

The first thing a man wants to do is to make a "good body of soap." What I mean by "good body of soap" is not a lot

of tallow and alkali boiled together for one or one and one-half hours, and the tank filled up with cold water, and called soap. There are a lot of finishers who do not know how to make soap. As I said before, they boil a lot of tallow and alkali, fill up their tank, and next morning, when they come in and look at their soap they can see a lot of streams of separated alkali in the tallow which look like curdled milk. When applied on goods in the fulling mill it turns into water, and there they are with a separation of alkali from tallow and they don't know what causes it. They lay the blame on the stock. Sometimes they can't get it out of the goods. Not only will it take the lustre off the fibre and make it brittle, tender, uneven from side to centre, or cloudy, but the colors will look mottled and dull.

The only way to make a good body of soap is to boil your soap in the dry state in, we will say, a 400-gallon tank; put in 100 gallons of water; bring to a boil; add your soap when well dissolved; add enough alkali to saponify your fat; but remember when you apply this (alkali) that it must be done very slowly, stirring up at the same time. If it is convenient to dissolve the alkali separately, it would be a very good idea; if not, do as stated above.

Boil the contents for at least four or four and one-half hours, after which time fill the remainder of the tank with, if you can, warm water; if not convenient, connect steam and water pipes above top of tank so as to pour your water from the bottom of tank and at the same time heat your water before striking said soap, with which it will be mixed very easily, allowing both steam and water through the same pipe; and you will have a good and substantial body of soap that will not only start your grease without injuring the fibre, but will saponify easily, help your felt, etc. Fulled very slowly, it would be a good idea to have about 100 yards in length so as to give it plenty of time in the fulling mill. We are after a good felty feel and a lot of felt to cover up the twill when finished. Be sure that you have enough soap in fulling mill, but try and keep damp. It is a very good idea to pull the goods out and shake once in a while so as to cool them off and keep from rolling up; if they roll up too much along selvedges, tack them. Scouring is one of the most important processes in finishing. You must start your grease by adding a little soap with lukewarm water. Clean off in thirty minutes with lukewarm water by applying easily. Give a second dose of soap to make sure

that your goods are clean and free from all tallow or alkali, and it will be a very good idea to find out if the picking room is using any repress saponified oil; if they are, be careful and get out, as the goods are to be carbonized; it would be a very good idea to give them an ammonia bath before taking them out of the washer.

I would carbonize them after scouring. Some do it before dyeing, but sometimes in either gigging or other processes they might get dirty accidentally, and not only this, but it saves dry fulling; and sometimes vegetable matter in stocks burns out, making pin holes you can see when finished, while in the other way gigging and steaming will cover them up so that you can't see them.

Neutralizing is the next process, with either alkali or ammonia and warm water.

After these goods are well neutralized, it is a very good idea to crab them, not only because it will benefit the lustre, but it sets them more evenly, frees them from wrinkles and makes them feel firmer after being finished.

Gigging comes next. You must start to gig very slowly, and go down gradually, as the fibres loosen up. When quite loose, reverse them, and, the same as before, proceed slowly and down gradually, until you can raise the nap by the aid of a long needle or knife-blade, and every fibre must be free from the body. When finishing the gigging, wet gigging must be applied, so as to set the nap for the steamer. Steam ten minutes on each cylinder, or according to how many pieces; if four pieces, the above will do. Cool off after each steaming; extract and dry in the gray; shear back once so as to get it free from all suspicious knots or ends, etc. Shear face almost as low as it would be after being finished. Bring back to steamer and steam for fifteen minutes on each cylinder. Cool off after each steaming; roll up, and stand roll on end for a few hours, and then reverse it, end for end, for a few more hours; send to dyehouse off the roller. If there are tight selvedges it is a good idea to tack them. When dyed and extracted, straighten on a brush and dry. Shear them low enough so that they won't rough up. Dew them on the face, but look out for water spots. Press on either rotary or hydraulic; just after pressing, steam on brush one run. They are then ready for examining and shipping.

# WOOLEN CARDING.

## ESSAY NO. 35.

While discussing the prize essay articles with a friend of mine, the subject of woolen carding was brought up. He claimed that he was interested in following the prize articles; also that his carding did not meet his requirements. I asked him in what way. He said that every article on carding was about the same, as it stated how to prepare stock, also how to set the cards. I told him that all stock had to be prepared, also cards were set to receive the same. He stated that he knew that, and claimed that any practical carder ought to know it, and that as his idea of a prize essay was to mention something that was not common, and that most carders had not been up against, he felt disappointed in the articles. I gave the matter very little thought at the time, but as days have passed by it has come to me more forcibly that my friend was right. What we want is to learn. Therefore, I concluded that I would write the following for the prize essay.

About four years ago I was working in a mill where we made fancy goods of all descriptions.

The waste was never put back into the same batches, as some mills do, but was sheeted up and piled away. When we got from 10,000 to 15,000 pounds on hand it was decided to make some overcoating goods and use up the waste in both the face and back of the cloth (which was to be filling backed goods). The backing filling was one run. Our trouble began on the cards, on the first and second breaker; we had Apperley feeds all through. It appeared that the roving kept breaking just as it left the cylinder and at the mouth and nose of the tube. We tried several different methods to make it stay up, but they seemed to fail. I will mention several different things that were done. At first the comb was set closer. Finding this was of no use, it was set farther away. Still our ends would break. Then the can or drum was taken off. This caused the roving to bag or sag in the centre, and it being so heavy it broke down. As this was the first time that either of us had ever seen it act in this way, we were at a loss to know what to do. We even went so far as to get two carders from other mills. They suggested several things. After they had been tried, we were no better off than at the start. Then they decided that the stock was too tender. The super-

intendent claimed that he had run the very same in other mills and that it ought to run here. So after trying two days and not producing a pound of yarn, it was decided to take a good strong warp yarn bobbin and place it at the opposite side of the card on the floor and let it run across the card just below the comb and out through the tube for the purpose of letting the roving wind around it. This we found acted very nicely. It would run for an hour at a time without breaking. After running a day or so this way, we decided that we would try and stop the breaking altogether. After passing the warp thread from the bobbin from one side to the other, we found that it only broke at the mouth or nose of the tube and then only about every hour. We knew that the trouble was in the tube. We set it farther away from the card at first and found that it made matters far worse, so then we knew that we were going in the wrong direction. We at once set it closer to the cylinder and found that the roving did not break any more at the mouth, but would continue to break at the nose. So then we took the tube off and had one inch taken off it, making it one inch shorter. We put it back on and found that it ran all right and never gave us one bit of trouble. We did the same at the second breaker and it acted just as nicely as could be desired. We ran all our stock out this way and had an easy thing of it. The only trouble was that the boy had to watch the warp bobbin at the side of the card, and as fast as one was empty replace with another. One day the boy let the bobbin run empty and forgot to replace it. The carder came around and saw the roving running all right. He stood and watched it for an hour, and it never broke. So ever after we ran the lot out without the bobbin of warp yarn. I trust this may prove useful to carders who have never been troubled in this way but are liable to be. I will state that I never saw this thing occur before or since.

## WOOLEN AND WORSTED FINISHING.

### ESSAY NO. 36.

The finishing of to-day and of years gone by differs so much that I doubt if our forefathers would know where to begin. Among the many improvements in years gone by, finishing

has, like others, had its turn. While we have improved on some classes of goods, on others we have not. It has been the main object, it seems, to not only shorten the hours of labor, but to do away with the labor, thereby lessening the expense. For this purpose we have adopted the up-to-date fulling mills, washers, shears and dryers, and with all these new improvements we are not much better in regard to the finish we put on the cloth. There is yet a wide field opened for improvements as to the appearance of the cloth. While we have discarded some poor ways of finishing, we have also discarded some very good finishes, which, in time, will come back. Take goods fifteen years ago and compare them with goods of today and we find a vast difference. Fifteen years ago goods were practically made in the finishing, while to-day they are made in the loom. Take these goods of to-day that are made in the loom and put the old-time finishing on them and we would, no doubt, have one of the firmest and finest pieces of goods ever made. From this one would naturally think that we should adopt the old style finish. There are several reasons for not doing so. The first and main reason is that in order to use this finish, on most of the goods, we would not only have to construct our cloth differently, but would also have to use better stock. We must remember that in olden times the profit was larger. While they could afford to use fine stock, we cannot, but use substitutes instead. The second reason is that it required two to three times the length of time to finish a piece of cloth that it does to-day. They could afford this time; we cannot. For this reason, also, we do not get the profit which our forefathers did. Therefore I say that when we have to decrease the time in finishing, we also must on some goods detract from the appearance. For instance, let us take the cassimere finish of to-day and the one of days gone by and compare them, and what do we find? The cassimere of to-day looks nice, feels nice, and to all appearances, is all right. Take a suit of clothes from it, and after it is worn a few times, it begins to hang like a bag, and needs pressing. Then get caught in a rain storm without your raincoat and it is worse than a rag. Even if one has a raincoat, the part below the raincoat looks so shabby that we are obliged to have it attended to. Wear this same suit constantly for a while and it begins to look threadbare, so that we are ashamed of it. When this happens we begin to run down the stock and claim all manner of things, which may be right or may be

wrong. It is not always the stock that will cause this, although I will admit that at times it has a lot to do with it. We can take a suit of the best stock and after a while the result is the same. Now take a suit of the same stock made in olden days, and it will hold its appearance better and longer than the one of to-day and it will wear one-third longer and not look half as threadbare as to-day's goods. Then comes the question, Why does it wear longer and look better, when the stock is the same? This is where I claim that the finish plays a very important part, and will go so far as to state that it is all in the finish. To-day we have what we call the regular cassimere finish that we use, and think of none other, but in years gone by we had what was known as the velour finish, which is one of the best finishes ever used for goods of the cassimere grade. As it will take an article of itself to explain this finish I will not mention it in this, any further than to say that I believe that the day is not far off when this finish will be adopted again. Most of the older finishers know what this finish is, and the advantages it has, while some of the younger ones probably have never heard of it, and for their benefit I shall explain it in my next article.

## WOOLEN AND WORSTED FINISHING.

### ESSAY NO. 37.

In this article I shall dwell principally on the velour finish, which is a hard finish that gives a soft effect to the colorings, also a good firm body to the goods and enables them to wear one-third longer than the regular finish of nowadays. This finish requires a close and firm felt, and in order to get it the process is as follows: Take the cloth from the loom and put it through the same processes of burling and mending as all goods are subjected to. Then full to the desired width and length, using a good, strong soap.

After fulling, comes the scouring. Do not use any extra soap, as the soap used in the fulling ought to be strong enough to raise a good lather while scouring. After scouring ten or fifteen minutes, take the goods to the extractor and extract. Be careful not to extract too dry; instead, leave all the moisture in the goods that they will carry. Then take the

goods to the gig. If the work is done on a teasle gig, it can be best produced by frequent changes. The idea is to raise a nap which will be good and thick, like that of velvet or plush, and by reversing the gig or cloth you will keep the nap straight. Napping the goods while wet will necessitate the frequent changing and drying of the teasle slats, but it will be worth the while and pay in the long run. After napping them well, take them to the dryer and dry thoroughly. Then press. When the cloth is pressed, it will most likely have a sharp feel that is not at all desired, but this will all come out when the goods are put through the steaming process, after pressing.

The steaming should be sufficient to take off all the gloss caused by pressing and also to raise the nap, so as to give it the full benefit of the velour feel and touch. On account of this steaming, the pressing ought to be very hard, so that the body of the cloth will retain a good degree of pressure after the steaming. After the cloth comes from the dryer, if convenient, a dry beating will help it wonderfully. When shearing, do not shear too closely; instead, have a short, thick nap.

Some people think that all the gigging these goods are put through helps to shorten the wear of the cloth, but such is not the case. It will not only improve the appearance of the fabric, but will lengthen the wear and it will not become threadbare, as is the case with the regular finish. Of course, cloth finished in this way, being felted harder than our regular goods, will call for better stock, and of an entirely different construction, and the sooner we get down to it, the better it will be for all. We are constantly having calls for a harder finish on our goods, something that will take away the cheviot effect and produce one that it similar to the melton. This velour finish will do just what is required, and will give a nice, soft effect to the colorings, along with the good feel. This is no new finish, but a very old one, used as far back as I can recollect, and when used it always gives very good satisfaction.

## BLENDS OR MIXING FOR COLORS.

### ESSAY NO. 38.

It is safe to say that not one man in a thousand has a practical knowledge of blends, or colors produced by mixing

colored and white stock in the opening department and picker room, for while mixing for colors has been practiced by painters and others since time immemorial, textile colorists are just now taking it up, many of them with very unsatisfactory results, because of a tendency to irregularity in color, which is usually termed crocking.

But blending is easily practicable. Take a gray or drab, for instance.

Following is a formula for gray: 20 per cent. black, 80 per cent. white.

For a drab formula use 30 per cent. black, 70 per cent. white.

The stock should be run off the breakers separately, feeding three white and one black to the intermediate lappers, which will produce a black and white mixture that is to be fed to the intermediates again at a ratio of three mixed to one white lap, which produces a lap ready for the finisher, feeding four the same as for white cotton. This method gives an approximate doubling of fifty and insures a regular distribution of color and a very desirable gray for blankets and napped dress goods.

Among other good reasons for coloring in this way is the very important fact that it is the cheapest method known, doing away with the necessity of handling a large amount of raw stock in the dye room and warehouse; besides, it runs better in the preparatory departments than fully dyed raw stock.

A pink and tan formula may be given as follows:

Pink, 25 per cent. red, 75 per cent. white; double 108 times, keeping proper proportion in view. Tan, 30 per cent. brown, 70 per cent. white; double 72 times. This is a hosiery staple.

Other colors can be made by anyone with a knowledge of the four primary colors. More doubling is required for some than others; shades nearly white I have doubled 136 times. This might cause some to think that the old style method was best, and most economical, but the best argument in favor of blending is that wherever it has been tried, under competent management, it has not been discarded.

A great deal of trouble is caused by using soap or belt dressings on the evener belt. Nothing should be used on an evener belt, not even castor oil, as a dressed belt does not produce an even lap, and an uneven lap produces an uneven blend. Much could be said along this line, but it would be out of place under the above caption.

# WOOLEN AND WORSTED WEAVING.

## ESSAY NO. 39.

In the production of woolen and worsted cloths smartness, strength, solidity and firmness are among the most important characteristics desired.

In these days of keen competition great risks are often run by constructing cloths in a cheap and inferior way, resulting in tender goods and heavy financial claims, which, by the consideration of the above-mentioned particulars, might have been easily avoided.

Perhaps the class of materials used in the manufacture of cloth is the most important of all. The wool or other raw product from which the yarn is made should be sound and strong, not necessarily fine, but more particularly firm and durable, capable of resisting an ordinary amount of wear and tear.

In constructing a fabric, equally sound material should be used in the weft as in the warp, but when the exigencies of the market will not allow this, the stronger yarn should be used for the warp and the inferior for the weft or filling.

While this is a practice which may be resorted to in case of necessity, it is not one which is to be taken undue advantage of, as should there be too great a difference in the strength of the materials used, the cloth produced might be strong warp way and very tender weft way.

Divers methods are, of course, in vogue in making cheap and durable cloths, such as using two-fold warp with single weft, or by backing the cloth in the warp or weft way with an inferior material, the appearance of the fabric on the face remaining to all intents and purposes the same. The principal part of every cloth should always be of a sound, strong material, capable of joining the groundwork of the fabric into which the inferior threads (if it is necessary to introduce any) may be interlaced.

Another very important point is the construction of the cloth, or, in other words, the manner in which the different threads interweave with each other. Plain or cassimere twill makes produce the firmest cloths because they afford the warp and filling threads an opportunity of interlacing and binding with each other unobtainable by any other weave. In makes of this description the warp and weft threads cross and re-

cross each other the same number of times, another point which tends to impart firmness and solidity to these cloths.

To obtain the best results on this principle there should be the same number of ends per inch in the warp and the filling and the same number of counts should be used.

In constructing cloths of the sateen or doeskin style, where the warp or filling threads float more, a larger number of threads per inch should be inserted; in fact, it may be laid down as a general rule that the greater the float in the weave, the more numerous should be the threads in the warp and filling.

Cloths are often seen constructed with a doeskin weave which have been positively tender, simply because they have been woven in too coarse a set. No doubt some of these cloths were woven with a fewer number of ends than was desirable in order to obtain the fine face of the doeskin at a cheap, easy price, but it never pays to make a fine-looking cloth, however reasonable the cost may be, unless it is firm and strong. A cloth overbalanced like this is sure to slip at the seam (especially in trousers) and cut at the bottom.

If a little more attention were paid to the general rules of cloth construction, such goods would never be made, and many returns and claims would be avoided.

Profits, of course, are now very small, and wherever a few cents per yard can be saved in the production of a piece, it is done; but whenever the fundamental rules of cloth construction are deviated from, risks are inevitably run and consequences are likely to follow which it is impossible to foresee.

In the designing of cloths, where we are surrounded by an almost innumerable quantity of styles and different results, the student is often puzzled as to which is the best method to adopt to find how many ends and picks he should introduce to produce the perfect cloth. Rules are often thrown aside if the cloth is intended for some special purpose, but for practical and commercial results we have always found the following rule to give the best results in plain twills, and often the same rule can be applied to more elaborate designs.

Find the diameter of the yarn; deduct 10 per cent., which gives the number of threads that would lie side by side in one inch; half of this number would be necessary in a plain cloth, and it then becomes a matter of simple proportion to find the number required in any of the plain twills:

Example: 2-30s equals 15s; 15x560 equals 8,400; square

root of 8,400 equals 92 nearly; less 10 per cent. equals 83, number of ends that would lie side by side in one inch. Half of this number (say 42) would be required per inch in plain cloth, the other half being allowed for the intersections.

Now, say we desire to find the number of threads to put in a six-end twill 3—3 of 2-30s yarn to produce a perfect cloth. Rule: As the number of ends plus intersections in the new cloth is to the same number of ends plus intersections in the plain cloth, so are the ends per inch in the plain cloth to the ends per inch in the new cloth; viz., 6 plus 2 is to 6 plus 6 as 42 is to 63.

Add 5 per cent. for waste. As the diameter of the yarn was found in the grease and the above rule is intended to apply to finished cloth, the diameter of the yarn would be somewhat less, owing to the loss in finishing. Therefore 66 threads per inch is the number we require in a 3—3 twill of 2-30s worsted.

We may say that the above rule has been well tested by applying it to some of the best-selling cloths on the market, and found to conform to the building and construction of these fabrics.

The subject of cockling is full of interest to the manufacturer as well as the student, because it is one about which there are so many opinions held. It is difficult to trace it to its right source; moreover, it is very disastrous to the trade.

Cockled cloth has the appearance, when laid on the floor, of covering a number of cobbles, some large and some small. Sometimes the cockling extends the whole length of the piece and often only for a few yards; sometimes it is possible to see the cockling when the cloth has left the loom, and the tension is taken away; but if it does not manifest itself here, should there be any tendency to cockling, it is certain to be seen after the milling process. Cockles are often minimized by the finishing processes, but as soon as the cloths are exposed to damp weather the cockles return to as large an extent as before finishing.

Bad blending, the employment of two or three kinds of raw materials, such as cotton or silk and wool or worsted, the latter shrinking much more in scouring than the former, and very often causing the cloth to cockle, the combination of various weaves, where the intersections are more numerous in one than the other, often cause the cloth to cockle.

Uneven warping and uneven creeling are prolific causes of

this trouble and should be well watched by the overseer if he would escape trouble of this kind.

## COTTON SPINNING.

### ESSAY NO. 40.

In order to spin good yarn, it is necessary that the sliver from the card should be delivered to you in a proper condition, that is to say, a good, smooth, even sliver of uniform size, otherwise it will be useless to make a decent thread. Even when the sliver from the cards is in proper condition there are then many different things which cause faulty yarn which are up to the spinner to avoid. We will take it for granted that the sliver up to the spinning frame has been made in proper shape and then proceed from there. I shall endeavor to name some of the causes of faulty yarn and the remedies for some. It is not only essential that a yarn should be made that will weave well, but also one that will be smooth and of even appearance. Almost any ordinary spinner can produce a thread that will weave, but the question is, how will it appear in the woven goods? The writer has seen yarn of such character weaving, and would ask no better, as far as weaving is concerned, but as far as the goods are concerned I would not buy such, as they look uneven, streaky and spotted, all of which is due to the spinning. The best way of testing the appearance of cotton twist yarns is by using a mock twist, say black and white. All imperfections will show on this class of yarn much more readily than on white or any other solid color. I have seen some yarn in which the twist was very uneven and irregular; again I have seen some yarn lumpy. This yarn would have all the way from 16 to 20 turns per inch of twist in it and all of it would come off the same doffing.

To make matters worse, I have seen the very same thing occur on one bobbin. The start of the bobbin would be all right, that is to say, have 16 turns per inch in it, and the centre of the bobbin would have as high as 20 turns; in fact, the bobbins of yarn would vary all the way through in just such a manner. Again, other bobbins on the same frame would come off in the same doffing all right, with the exact

amount of twist in them from start to finish. Had all of the bobbins in the same doff acted the same as the first bobbin mentioned, we would naturally say it was caused by something slipping, such as the twist gear, or the cylinder drum, but such not being the case, we know that the fault was elsewhere. There are a lot of spinners who have worked on knitting yarn and think that it is mere play to run a spinning frame. They have a very absurd idea, for let me say that any person with average intelligence, after working 18 months in the spinning room, is capable of making knitting yarn, as this is one of the simplest and easiest yarns to make; but when they come to make a yarn of finer counts, such as mock twist, they find out that knitting yarn is only a mere apology for spinning, that is to say, the average knitting yarn that is being made to-day. Now let us go back to our first subject and find out the causes for uneven yarn, also why one bobbin will have a different amount of twist in it all the way through. As I said at the beginning of this article, there are several different ways by which this can be done, and when one finds them out they are very simple, yet they cause us a lot of trouble. My idea in giving these different remedies is that it will be the cause of enlightening some spinners who are now in the dark.

The first and main remedy for this is in the bobbin itself. At every doffing the spinner or second hand should be at the machine in order to see that the bobbins are put on the spindle properly. If the bobbins are not put down good and tight, it will allow them to slip occasionally on the spindle, and every time one of these bobbins slips there will be more twist put into the yarn. This will continue for several yards of thread, even if the bobbin only slipped one turn, but if the bobbin kept constantly slipping, there would be a soft, big bobbin that would be of no account. This would really be better for the spinner than a bobbin that had only slipped once in a while, for the one that was constantly slipping would be thrown out as a bad bobbin, but the other would be passed as good, and this would be where the trouble was caused. Another place where yarn can be made faulty from good sliver is in the rolls of the spinning frame. The yarn sometimes will slip in under the rollers. When this occurs, it means a coarse thread, as far as the slipping continues. The main remedy for this is to keep the rolls clean, free from dirt and grease or oil. Watch these two points and you will have a good smooth thread.

# THE MELTON FINISH.

### ESSAY NO. 41.

A piece of melton cloth, made and finished rightly, is considered a very good fabric. There have been a number of mills which have attempted to make these goods and have failed, simply because they could not get the desired finish. Some mills make a fatal mistake in the lay-out for these goods, also in the stock used. They seem to think that a melton can be made from waste alone, and such is not the case. The most important thing to a melton being the finish, I shall give what is considered one of the very best finishes.

In the first place a melton should never lie over 84 inches in reed. Some mills use 80 inches, but only when they use more ends in the warp. Lying wider has a tendency to give a spongy appearance to the cloth after being fulled. The requirements on these goods call for a smooth, close surface and a good firm felt. In order to obtain these results the goods in fulling must be trapped up in length as well as being fulled in width. The shrinkage in length should run from 10 to 20 per cent., dependent on the stock used. Most generally 20 per cent. is used. Before starting the cloth in the fulling mill have the goods tacked well, face inside, then pour on soap gradually until the piece is thoroughly moistened all the way through evenly. Care should be taken not to have too much soap put on, as this will give a spongy piece of goods. These goods should full from four to six hours. Under no circumstances should they full under four hours. Some people think that by rushing the fulling they are gaining time. This is a mistaken idea, and the sooner one rids himself of this idea the better it will be for him. Never at any time must you let the mill get too warm; if so, the goods will be fulled too quickly and the consequence will be seconds. As the fulling is one of the principal things in the finishing of meltons, it should receive very close attention. If you find the mill getting too warm, open the doors to cool, but do not stop the fulling mill. The trapping or shrinkage in length should be in comparison with the fulling in width. By this I do not mean that the goods should be taken up in length as much as in width, but that the trapping should be done in accordance, that is to say, not too quickly. When the cloth is fulled to width, the trapping should be exact as to length. This can be easily regulated by the weight used

on the trap. To make this a trifle plainer we will say that the cloth comes from the loom 72 inches wide. We intend to shrink 20 per cent. in length. This means that for every two inches that the cloth goes in in width, it would have to come up one inch in length to be uniform and come out even. I will add that the amount of shrinkage in length may best be determined by the good judgment of the finisher.

In the scouring of this class of goods too much care cannot be taken in the rinsing, as the firmness of the cloth renders it hard to remove all traces of soap. The liberal use of warm water is advisable before using the cold water. Before shearing run over the steam brush with a moderate application of steam. This will help to raise the loose fibres which are cut off in the shearing. Now comes the shearing. Be sure and have both the raising and laying brush in good working order, as all the loose fibres should be raised up and brushed out, so as to be cut off. If not, they will become imbedded in the cloth and will spoil the appearance. Be careful and see that the lay brush is thoroughly clean before starting to shear, as this brush easily gets filled up and when in this condition will be of no earthly use whatever.

After shearing, the goods should be moistened by steaming. Then press. After pressing, if the goods have a glossy appearance, which dark shades are more or less likely to have, a good steam brushing will remove all traces. These are the principal things regarding the finishing of meltons. There are other details attached to meltons which are generally known to all finishers; therefore I shall not go into them.

## FINISHING WOOLENS AND WORSTEDS.

### ESSAY NO. 42.

It is advisable for every finisher to have every piece of goods inspected by a responsible percher.

As will be readily understood, a good light is most important for the inspector to do his work. The perch over which the fabrics are examined consists of two rolls, usually attached to wooden hangers fastened to the ceiling, or it may be on posts in the room; in either case it should be in such a man-

ner as to bring the fabrics, when pulled over the perch, squarely in front of the window.

Two persons, as a rule, attend to the perching of 6—4 goods, the inspector on one side and his assistant on the other, in front of the fabric to be examined, pulling the fabric slowly over the perch, both persons examining the fabric carefully as to imperfections. These may be caused by the carelessness of the weaver, poor yarn, etc. However, no matter what the cause, it is the work of the inspector to detect these mistakes, which later require attention, and when found, mark them clearly with chalk for the purpose of calling the attention of the sewers to such places, whose work it is to darn and repair them.

The aim of the inspector should be to bring the goods out as nearly perfect as possible, and at the same time have as few allowances as can be had. Both the face and back of the fabric should be examined. In some instances, in connection with the light-weight fabrics, the examination is made from behind the goods, the inspector, or more often his assistant, changing his position by stepping in between the two runs of the cloth, which brings one of the runs between him and the light, in turn, enabling him to look through the fabric, and consequently readily detect any imperfection. When the inspector has carefully examined the goods, and marked all imperfections, the piece is taken to the burlers, who are girls, and usually two girls work together on a table, in connection with 6-4 goods. They commence to examine the fabric with its back up, for such imperfections as knots, bunches, etc., using for this purpose both their eyes as well as their fingers, and, in fact, the latter more particularly. The tables used for burling must be smooth, so that the burlers, when feeling for the knots or bunches, etc., will not come in contact with obstructions on the surface of the table. The table should have its top fastened by hinges on one side, thus permitting the tipping of the top to any angle, to suit the size of the girl, the top being held at this proper angle by suitable movable braces placed on both sides of the table. This also permits the top to be let down level when the piece is finished. The cloth is then folded on the top of the table before being taken away.

In some mills the tops of the tables are covered with zinc, so that a perfectly smooth surface is obtained; in this case care must be taken that when this covering is wearing out,

it is promptly repaired, or the entire top recovered, to prevent damage to the cloth being burled over it.

The girls should be provided with proper burling irons and a good pair of scissors, the scissors to be used when cutting off knots, which should never be pulled off, since by this procedure the respective threads in the cloth would become unduly tightened, and when released crawl back in the structure of the cloth, leaving an imperfection, a space without a thread, consequently a chance for an imperfection to show in the finished goods.

All the knots which have been tied in the threads during winding, dressing and weaving must be looked and felt for during burling, and carefully drawn by the girls to the surface, and then clipped off, leaving the ends long enough so that no space without a thread will occur. Threads which are found loose on the face or back, caused by the weaver having tied in a broken end, should be cut off and not pulled off, especially if the thread in question has been interlacing tightly; however, the threads interlacing loosely should be pulled to their proper positions first. A bunch must be drawn out a little at a time, so as not to disturb or strain the thread to which it is fastened, or the surrounding threads. The same care must be exercised with runners, caused by the filling having been drawn at the selvedge into the cloth. After the back of the piece has been carefully burled, the face is taken in hand by the burlers. Here the removal of knots is attended to with more danger than on the back. It is usually sufficient to draw the knots to the surface and leave them there for the shears to clip off. Bunches in the yarn, and runners of the filling, will also require considerable attention in removing them carefully, that no harm to the cloth may be done. All places where runners have been taken out should be marked, so that the mender can examine such places to see if it has been done in such a manner as to cause no damage to the joining picks.

In other words, each knot or other imperfection is removed either from back or face, wherever it is easiest to get at it, when dealing with single-cloth structures. When in connection with double-cloth fabrics, the place, whether face or back, is properly defined by the ply of the fabric in which the imperfection is located, as will be readily understood from the construction of these fabrics. After the piece is burled, it is then taken to the darner or mender, who is also called a sewer; this work as a rule is done only by experienced girls.

In fact, the person must be what we may consider an expert with the needle, in order to do perfect work.

The object of darning is to bring the goods up to perfection before they are allowed to undergo finishing. It is a good plan, where sufficient room is available, to give each sewer-in the use of a perch for doing her work, since this will make the work easier, and allow her to do it better. If the person knows weaving, this will also benefit her in her work. On fancy work it is essential that the sewer should understand the colors used for producing the various effects and have a good eye for imitating, taking adjoining patterns for reference both as to the interlacing of the threads and the coloring, thereby making a nearly perfect affair of some of the most imperfect places, work which requires experience as well as attention. On plain goods or mixes the weave alone will come under consideration, all kinds of sewing-in being more or less regulated by the kind of final finish of the fabric, thus indicating that more exact work is required for a threadbare fancy piece of cloth, requiring little, if any, finishing afterward, than if dealing with a face-finished fabric, where gigging, that is, raising the nap on the face of the goods, will cover many imperfections, never to be noticed in the finished goods. The work, however, is tedious in the extreme and trying to the eyes, though experience comes to the aid of the person, and after a while imperfections are corrected to a nicety which appeared hard or impossible to be remedied. With reference to some kinds of plain face-finished fabrics, the cutting out of good picks, in place of sewing in a missed pick, is frequently resorted to, for sewing-in of mispicks is generally found to be too tedious.

To do this cutting-out of a good pick in order to remedy a mispick requires a knowledge of weave formation in order to know which picks have to be cut and which not. Unless this is well understood by the sewer, it is best not to attempt it; in fact, it is no use for the sewer to attempt anything in the line of darning unless it can be made to look almost perfect in the finished fabric, so that an allowance need not be made. After the piece of cloth is mended and all mistakes possible attended to, it is then ready for the fulling mill or washer, as the case may be.

The tacking of woolen goods for fulling means the stitching of the two selvedges, face inside, either by hand or machine, and it is done for two reasons: First, it has been done with

fabrics requiring flocking, in this manner keeping the flocks from the face, most of which, during the process of finishing, would only be lost again; at the same time introducing flocks on the face of the goods would vary the shade of the individual pieces, since the color of the flocks varies constantly, thus making it hard, if not impossible, to match the goods for filling a case. Second, woolen manufacturers have found by experience that in connection with fine face goods which have to run in the fulling mill for some time, tacking them will protect the face of the goods from chafing during fulling, and the face of the goods cannot but be benefited in its general appearance when finally finished; at the same time it prevents the selvedges from curling over or rolling and from being caught and torn in the fulling mill; light and delicate colors cannot be affected in exposed places by strong soaps, and many stains caused by the uneven distribution of soap, or by soap which would otherwise get on the goods during fulling or washing, are avoided, and the goods are preserved in such good condition that it helps greatly in all after finishing processes. The matter of preventing the selvedges from rolling or curling by means of tacking them allows the combination of uneven weaves to be used more extensively in the construction of fabrics than would otherwise be practicable.

Another advantage of tacking is found in connection with piece dyes, and there the tacking, besides being beneficial to fulling and scouring, at the same time is of immense advantage in getting even dyeing; that is, the goods take the dye the same on the sides as in the middle and do not shade off, one of the hardest problems to overcome in connection with piece dyes. When woolens are run in the fulling mills or washers, after being tacked, the air inside the goods causes the folds to change position each time as they pass between the rolls, thus avoiding fixed creases or wrinkles and the consequent streaking of the goods.

In addition to this, the goods will full much more evenly if tacked than if not, since when the goods are run in tubular form in the fulling mills there is no opportunity for the sides to flop around loose in the mills and thus be more exposed to the air, receiving less pressure and heat than the middle, and consequently not fulling as much. Tacking is also practiced in connection with worsteds for washing, fulling or dyeing, either one of these processes being done more evenly if the goods are run in the tubular form. Tacking was done by

hand, and in some mills this may yet be done, but the proper way to do it is by means of a sewing machine constructed especially for this work. After the goods have been tacked they are taken to the fulling mill. The purpose of fulling is to obtain the shrinkage required for the proper length, width and weight of the goods, at the same time putting the structure in such a condition as to permit the finishing processes to be properly performed. It adds strength to the goods, loosens any superfluous dyestuff matter adhering to the fibres, as well as all oil and grease added to the wool to permit carding and spinning, size added to the warp yarn for proper weaving, etc. This loss in weight of the fabric, as well as any further loss to the cloth during scouring, gigging, napping or shearing, or any other finishing processes, must be carefully taken into consideration by the finisher with reference to shrinking length of fabric in order to obtain proper final weight of cloth required.

There is another class of goods where, instead of shrinking the goods in their length, they are required to stretch a certain amount, making them come from the fulling mill rather longer than when they entered, flocks in many instances being relied upon to bring them up to a required weight. Different pieces ought to be sorted, because every different structure of cloth will full differently, and if two pieces of a different construction are put in the mill together, one will come up more quickly than the other, leaving one running alone, causing it to full more slowly, run longer and in turn become weaker than if run with one of the same style. The moisture required for felting is added to the fabric in connection with a good soap, which in turn exerts a softening influence upon the fibre, besides being useful in removing the emulsion which has been given to the wool stock in the picking room in order to be able to card the wool and spin the roving into yarn. Again, it will keep the goods from chafing and wearing off too much during the fulling process. The requirement for a good fulling soap is a hard soap which is free from caustic that is neutral. If caustic is present to any extent in the hard soap, it is sure to injure the colors more or less, if not the fibre, and if the color has been injured, it is impossible to remedy it. The strength of this soap for fulling depends upon the goods handled. It must possess sufficient body to turn out the grease from the goods and hold it in such a state that to all appearances it might be scraped off the cloth at any time

to the end of the process. If the soap is not heavy or has not sufficient alkali to start the dirt, grease, etc., in the cloth, cloudiness and dullness of colors are sure to result. For goods with extra bright colors and which naturally have been more carefully handled, use a good neutral soap liquor, lukewarm. Pour it slowly on the goods, not too much at a time, the weight of the goods determining this point. A good fulling soap can be made up as follows: 3 ounces of pure alkali, 7 ounces of palm oil soap, to one gallon of water; boil together about three hours; fill tank with cold water; use it on the goods cold. In solid colors, as mentioned before, a very small quantity of alkali may be used if any difficulty is found in forcing out the grease and dirt. Some claim that alkali assists fulling, but the proper way is only to help loosen the grease and dirt by means of it, the fulling not to commence until the grease and dirt in the goods become loose. One pound of good soap used in this manner will do more toward getting the goods clean than double the amount or more used later on in the washer, by preventing the dirt from first being felted in the cloth structure, making it hard to get rid of in washing afterward. Thin alkali soaps, if used, will run the dirty grease and dyestuffs through and through the goods, staining them and causing the colors to become dead. There will be found a great difference in the finished cloth between starting the fulling in a greasy condition and starting when this grease has been loosened, this being the reason why very delicate colored goods are washed before being brought to the fulling mills.

Heavy goods and fabrics, constructed with an extra heavy texture and such as carry in their body a considerable amount of grease and dirt, will frequently be found to full with difficulty, for which reason it is well to wash such goods also previous to fulling. This washing does not have to be as thorough as that which succeeds the fulling; however, it has to be sufficiently vigorous to loosen the foreign materials in the goods and give the fibres an opportunity to come in contact with the soap during fulling and thus to get all the benefit which is to be derived from moisture, heat and friction. It might be thought that washing the goods before fulling would make the fulling, so far as time is concerned, shorter, but this is not so. However, the distinct advantage comes in the appearance of the finished goods, together with their handle or feel and brighter colors obtained, all of which should repay the extra expense of first washing such goods. This previous washing

will also aid when dealing with cloth in which low grades of carbonized wools have been used. Then there is a considerable difference in the amount of time required for fulling these goods when they are washed previously and when they are not. If they have been washed for three or four hours with a good supply of soda alkali, previous to fulling, the time required will be reduced nearly one-third. Again, if shoddy is extensively used, as it generally is in these low-grade goods, then the washing before fulling will in many cases give the cloth the appearance of all-wool cloth, pretty nearly covering the adulterant. However, the shoddy in this instance has got to be in the right condition; that is, if it is carbonized, as it usually is, it must be washed free of sulphuric acid, since where this free acid is present, and the goods are brought in contact with a soda alkali, the tendency is for the formation of a combination upon the surface of the fibres which will act injuriously in connection with the fulling, since it is insoluble in water unless the water is considerably heated. After the goods have been soaped in the fulling mill and allowed to run long enough for the soap to spread and evenly wet the goods, the time to examine it has arrived. The goods running in the mill should be examined at stated periods to see if they come up even both ways, for if lacking in either respect, it must be attended to at once. If the goods do not come up lengthwise, as fast as they should, more weight must be applied to the trap, but if the supply should be exhausted, as will sometimes happen, then the pressure of the roll must be lessened, and in this way the shrinking sideways retarded, so that the goods may have a chance to come up lengthwise by the time it has sufficiently shrunk sideways. After examining the goods, it is a good plan for the fuller to scrape off more or less any soap which has spattered on the sides and other parts inside of the fulling mill and put such soap back on the goods, thus not only keeping the inside of the mill in a better condition, but at the same time using the soap to its full value.

Soap, if deposited in quantities and left for a time on the metal parts of the machine, tends to eat them away, and if left on them to dry will form a hard scum, which in time will become loose and fall on the goods, and in passing through the rolls is apt to do damage. However slight it may be, the accumulation of soap on the wooden parts of the machine will have a tendency to warp them more or less. It can be readily seen when the doors of the machine shut hard and the hinges

rust. If the goods are flocked, all the flocks and waste matter must be taken where they belong and taken care of.

The sewing together of the ends of the goods after they are put in the mill must be carefully done, making the seam firm and smooth, whether made by hand or machine. In the case of hand stitches, take small, even stitches, and in the case of machine stitches see that the seam is not made too deep into the cloth, and thus bulky in turn, creating a pounding each time such a seam passes between the rolls. Have the protruding ends of the seam turned inside, for this greatly helps its smoothness.

Pressure in a fulling mill for shrinking the goods must be put on easily and a little at a time. This will be found much better than putting on full pressure at once, from the fact that, if shrinking the cloth too suddenly, good felting is lost sight of. By taking this precaution the goods will not handle hard and wiry. If the goods shrink too slowly in width, a little additional pressure put on the top roll will help, the same as additional weights on the trap will help to shrink the goods in their length and vice versa, in both instances.

Provided the goods come up continually too fast in their length, it is a good plan to draw down the rods of the elliptic springs somewhat and thus increase the pressure of the rolls, but if this does not help, then the best plan is to double such pieces in the mill, thus increasing the volume of cloth at one time under the influence of the rolls, and at the same time shortening the piece by one-half, and consequently the goods will be under the roll oftener than if they were single. On light weights, two or three pieces side by side are generally run in the mill, in this way not only increasing the production, but at the same time causing the goods to run better all around. If goods are fulling too long, take them out and reverse the ends in the mill, and when they have run about half time, shake them out thoroughly from end to end. Heat is very necessary to the felting of the wool fibre, but care must be taken to avoid too high a temperature during fulling, since such would seriously injure the colors. About 85 degrees F. is a good average, possibly 90 degrees F. as the limit. Again there are some classes of colors very sensitive to heat and those consequently must be treated at a lower temperature, according to fastness of color to fulling.

Heat influences moisture and consequently as the fabric gets warm in the mill, a good deal of the moisture then in or

on the goods will evaporate, and it will not do to let the cloth run too dry, that is, short of soap, as the goods will chafe, resulting in loss in weight, creating more flocks, and the cloth thus fulled will not gig or shear clean and clear. As soon as the fuller sees that the pieces are not as wet as they should be, he must at once add a little more soap, remembering, however, that it will not take much to bring them again to their proper moisture. If it should occur, either through carelessness or otherwise, that too much soap has been applied to the goods, then the best remedy is to run, at once and quickly, a dry fabric in the mill, and it will absorb any surplus of soap from the fabric under operation. It must be clearly understood that without sufficient soap and heat the goods won't felt. They may shrink instead of felt, but this is not proper fulling. As soon as the goods are up in their width and length, the fuller must test the soap in the goods, and in every piece, provided two or more were fulled at one time, see if it has turned watery or not. When the pieces are handled and a gentle squeeze given, a little free soap should appear. This is a test that sufficient soap has been used, or that the soap has not lost its vitality by too long fulling. This test should not be omitted, since it will save trouble. In any case, where the soap does not show up, as thus mentioned, give the pieces an additional dipperful of soap before taking them from the mill, which then will help them in the washer. When the goods are taken out of the mill, remove the tacking strings, provided the goods have been tacked, after which open them out so that the air can get at all parts of the cloth, since they are then warm, and if left lying in piles it would start the colors and thus make them dull, unless they can go at once to the washer. Such an airing in connection with piece-dyed goods will also prevent the formation of streaky and cloudy places in them.

Flocking comes under the head of fulling and one of the disadvantages of flocked goods frequently met with is the tendency of the flocks to drop out of the goods and gather in the lining of the garment. For this reason such garments as are lined, as coats, have their lining loose at the bottom, so that whatever flocks work out of the fabric during wear will drop out of the garment and not get a chance to lodge in the bottom seams of the lining. However, when flocks come so excessively out of the cloth or garment (some will always more or less come out), it is a sure sign of an error somewhere, either

poor flocks, a wrong way of flocking or more flocks used than are consistent with the structure of the goods under operation. With reference to the flocking of the goods, there are several methods in use. All have their advantages and disadvantages. The best method in any given case will depend considerably upon how much weight has to be made up by flocking, how long the pieces will require fulling and also the grade and condition of the flocks to be used.

Dry flocking is frequently used for the reason that in this manner it is much easier to distribute the flocks evenly all over the cloth than by wet flocking. This method of dry flocking may give satisfactory results in connection with low grades of kerseys, meltons and similar fabrics, but it cannot be used in connection with the better grades of these goods, nor on fancy cassimeres, for the reason that too many of the flocks will work through the fabric and thus get on the face, with the result that the colors and the face of the goods will have a dull, muddy appearance. When flocking dry, the amount of flocks required to be used is put on the goods immediately after starting the fulling mill, and after they are well distributed over the goods, the soap is applied. The best way to do wet flocking is to take about one-quarter the amount of flocks calculated to be used and sprinkle them lightly on the goods when they begin to get warm in the fulling mill; after a while add another quarter of the flocks, and continue in this manner until all the flocks have been added. The flocks put on in this way will adhere as firmly as possible to the goods being flocked and fulled, since the flocks are fed to the cloth when it is in a condition to absorb them best, that is, when it becomes heated and the felting starts.

Half dry and half wet flocking is used when a rather excessive amount of flocks must be added to the cloth and where it would take too long to apply the flocks by the means of wet flocking, for the reason that the goods would have fulled up in width and length before all the flocks were applied. For this reason part of the flocks are given to the cloth in its dry state, and the rest after the goods have been wet and become warm. The cloth is next taken to the washer. When the proper soap has been used at the fulling and such soap retained its vitality to the end of the process and more, then there is no question that the scouring of the goods is an easy process, in fact only a rinsing, especially if able to use lukewarm water. If the soap as used for fulling loses vitality

before the process is finished or just at this point, the soap being of too light a body, then a scouring soap or liquor has to be used at the washing in order to get the goods clean. It is not necessary to have the body of this scouring soap or liquor heavy; quite the reverse. It is better to keep it light, and for this reason about two to two and a half ounces of soap and from two to two and a half ounces of alkali to the gallon of water are sufficient. Cheaper grades of soap may be used from the fact that it is upon the strength of the liquor that reliance has to be placed, and for this reason the amount of alkali should be somewhat larger than is used in a fulling soap. The strength of the liquor depends entirely upon the character and the condition of the goods. If dealing with colors not fast to fulling, it will not do to use too much alkali or they may be injured. When the proper amount of ingredients has been well combined by boiling, the tank is filled up with water and left to cool. Just before the soap is cold you may add to the mixture about one ounce of sal ammonia to the gallon, but if the alkali is ammoniated, one-half ounce will do. Stir frequently until well mixed.

Several pailfuls of this scouring liquor are given the goods, providing the fulling soap has lost its vitality at the fulling, and after giving them twenty to twenty-five minutes in this, it is drawn off and the proceeding repeated; after that the goods are thoroughly rinsed. Another important item for perfect washing is the kind of water to be used.

The best to use is warm water, but unless this is plentiful at hand, cold water will have to do. There is nothing which will have as beneficial an effect upon the goods at the washing as a good supply of lukewarm water. To always have an even temperature for the water is another item of importance. The temperature for the water should not exceed 110 degrees F. After the washer is started, turn on the warm water and fill its trough about half full, having previously closed all the gates. Then let the goods run in this water for about twenty minutes, when there will be ample evidence of the vitality of the fulling soap used; for if it is right, the washer will be filled to overflowing with a thick, rich lather, although dirty, for it is tainted with all the impurities of the goods, which have become loosened and entered into the lather by the use of the warm water. If the goods show such a lather, no scouring liquor will be required for the washing of the goods. The process of scouring is simply resolving itself into a procedure

of rinsing by drawing off the suds at the end of twenty minutes and entering another supply of warm water and allowing the goods to run in this again for twenty minutes. At the second scouring the lather should show up white, and still be thick and creamy. When in turn this second suds is drawn off and the washer is about half empty, turn on the warm water and rinse the goods with it as long as the supply will last, and then turn on the cold water and rinse till all traces of the soap are gone.

The time for this depends upon the supply of warm water at command and upon the nature of the fulling soap which has been used. With an unlimited supply of warm water at hand, rinse the goods about half an hour and follow this with about half an hour in cold water, when, as a rule, the soap will be found to be well out of the goods. Keep in mind that warm water will remove the soap faster than cold water, and if there is no warm water on hand, it will take so much longer. When using cold water entirely, it will be advisable to give the goods, at the second water, about a pint of diluted ammonia to each piece, which will help to loosen the soap and thus aid in its removal.

If at the first water the lather does not show itself to any extent and the suds look thin instead of thick and creamy, it is a sign that the vitality of the fulling soap is gone, for which reason a thorough washing must be at once given to the goods by drawing off this first water and giving each of the pieces several pails of a strong scouring liquor.

The softening and cleansing properties of fuller's earth are appreciated by all finishers who have come in contact with it, especially the refined product, which is much to be preferred to the crude article, and like any other article in the end will be found the cheapest. The former will better combine with water and the remainder will not be as great.

Do not use more of the earth than the water will hold in suspension with frequent stirring, since too much fuller's earth is worse than not enough. A good plan is to use to one barrelful of water, two pailfuls of the earth; using more will give unsatisfactory results. The proper time to use fuller's earth is any time after the goods are washed.

Burr dyeing has for its object the covering of the vegetable specks or impurities in the cloth. It will not affect a wool speck, which remains the same as if no burr dye had been used, and will have to be removed by hand finally. Burr dye

is made of logwood, blue vitriol and soda ash. A good receipt is: 50 pounds of extract of logwood, 25 pounds of soda ash and 12 pounds of blue vitriol. This should make about 100 gallons of burr dye that can be used with safety upon almost any kind of woolen or worsted, excepting cotton mixtures. When properly diluted, the dye will stand at about 10 degrees, and has to be diluted with cold water to suit the goods under operation.

This burr dye, as, in fact, all others, must be used only when perfectly cold. Again, it will not do to allow the goods to stand still in the liquor any length of time. Another good receipt for burr dye is: 100 pounds of extract of logwood, 50 pounds of soda ash and 25 pounds of blue vitriol. This should make about 100 gallons of dye, which also has to be reduced with cold water previous to using it. The extract of logwood as used for burr dye can without disadvantage be of an inferior grade, or hematine will do just as well. This logwood or hematine is put in a tank with sufficient water to fill it about one-eighth full. Add the blue vitriol which has been dissolved, then turn off after it boils moderately, and all the vitriol has been dissolved, then turn off the steam and let the liquor stand for a few hours to cool, adding at the same time a pail or two of cold water. Then add the soda ash, but remember, very slowly and carefully, since as soon as the soda ash and the vitriol come in contact fermentation sets in and the liquor will begin to boil and possibly run over the tank, and then the best part of the coloring matter will be lost. When all the soda ash has been added, let the liquor stand for some time in order to give it a chance to slowly work, and at the same time, if there are signs of it rising, add a little cold water. Agitate it gently until you can stir the liquor without its showing signs of much rising, then turn on steam and bring it slowly to a boil, and in turn keep this boiling up for about four hours. Next turn off the steam and fill the tank with cold water, keeping the liquor well stirred while the tank is filling. When the process is finished, the liquor should be of a clear and rich claret color. If the color is muddy and of a dirty blue, gray or black shade, it is a sign that an error in preparing it has been made and that the dye will give poor results when used.

The more soda ash there is used, the deeper a claret the shade will be, while if the amount of vitriol used is increased, then the shade will be more toward the blue than the claret. Sometimes it puzzles a finisher to know how strong a burr dye

should be in order to produce results. This naturally varies more or less with the kind of goods treated; that is, the character and abundance of specks and burrs which it has to cover, also with the method adopted in applying, as well as with the time when the dye is used. Under ordinary circumstances and upon a fair grade of stock the dye will be found to work well at 1 1-2 to 3 degrees.

The quantity of dye to be applied to the goods also varies with the amount of work which it has to do and with the method of its application. Some use the dye in the washers before gigging the cloth, when about three pails of the 3-degree dye to the piece will do the work.

The operation in this case is to run the goods in the washer long enough to thoroughly start the soap and dirt and not to add the dye until a good clean lather has begun to show. Each piece should run in its three pails of dye for at least twenty minutes before the rinsing in cold water has begun.

The best plan is to defer the burr dyeing until after the goods are gigged. In this case, although you may use the same amount of dye, three pails to the piece, it is only necessary to have it about half as strong as if burr dyeing in the washer, in order to accomplish the same results, 1 1-2 degrees in most cases being then quite strong enough for all practical purposes. Any batch of burr dye should be tested before it is used, and, if possible, kept exactly uniform for all similar styles of goods. Again it must be applied in even and regular quantities and the goods must always be allowed to remain in the dye for the same length of time. The dye is always best in its action when perfectly cold.

However, we must not only use cold burr dye, but the goods also must be in a cold state, and to make sure of this give them about five minutes' run in cold water after putting them in the washer. Be sure and have them well drained before running them through the burr dye tank or adding the dye in the washer, provided no special burr dye tank is used. In the latter case never leave water in the washer to reduce the dye, for such a procedure will result in uneven work. Always reduce your dye to the exact strength wanted before giving it to the goods. The liquor used for carbonizing is made by adding sufficient sulphuric acid to the water with which the tank is filled to make the liquor register 5 degrees B., after which the goods are entered and well covered with the liquor and left there for about twenty-five minutes, according to the con-

dition of the cloth to be carbonized. When they are ready to be removed, one of the ends is passed through a set of squeeze rolls fastened to the tank, and thus any surplus liquor squeezed out and saved for future use in the tank. It must be mentioned here that all the metal parts of the tank must be of bronze, for, if not, the acid will destroy them. The tank also should be lined with lead, or if of metal, it must be of a non-corrosive kind. As soon as the goods leave the squeeze rolls of the tank they should at once pass to the extractor, with no more handling than is absolutely necessary.

This extractor must be acid proof and its drainage such that all liquor extracted from the goods returns to the tank and is rinsed. Always keep the acid bath in the tank at its proper strength by adding to it from time to time more acid as it is required. From the extractor the goods are taken to the drying room to transfer the vegetable matters, now completely saturated with sulphuric acid, by means of drying under excessive heat, into dust, in which state the vegetable impurities have to leave the cloth.

The drying room is supplied with numerous steam pipes in order to be able to quickly raise the heat to a high point, the steam pipes being placed so as not to interfere with the goods, which are loosely hung up in any way to get the heat at all points of the goods. After being hung up, the room is closed and the steam turned on and the heat run up to at least 175 degrees F., since at that point only will the baking process be completely accomplished. In other words, the strength of the acid bath, as well as the heat in the drying chamber, must both be up to the required point for perfect carbonizing. After thus carbonizing the vegetable impurities in the cloth, they in turn have to be removed. This is done either by dry heating the cloth or, in the case of bad pieces, by means of a heated fulling mill, this fulling mill being supplied with steam pipes placed out of the way of the run of the cloth. Running the goods in such a hot fulling mill for about one-quarter of an hour or less will remove any trace of carbonized vegetable fibre, provided the process itself was well done.

The next thing to be done is to send the goods to the washer and give them a bath in a solution of soda and water for about twenty-five minutes, in order to neutralize the acid, after which rinse them well. Adding fuller's earth to the latter procedure will greatly help. Previous to taking the goods out of the washer, it will be advisable to ascertain if neutralizing

has been thoroughly accomplished. If acid still remains in the goods, they will feel slippery and then another soda bath has to be given to the goods, to be followed with a rinsing. The cloth is next steamed or stretched. This is generally done in connection with goods which are to receive a face finish.

The steaming and stretching machine ordinarily receives the cloth from the extractor and its object is to smooth out the wrinkles, prevent lightning effects, caused by too long fulling, to sadden the cloth to its natural state and finally wind the cloth onto wood rolls ready for the gig or napper, as the case may be.

For improving the lustre and feel of face finished goods, as well as to remove wrinkles and creases in cloth that has lain around for a long time, and for steaming and stretching in general, this machine will be found of special advantage. It is built with a boiling tank, so the cloth runs through boiling water, the latter being boiled by perforated steam pipes set in the tank, in which instance the machine is termed a boiling and stretching machine. Some machines are built having both attachments, steaming and boiling, added, and either one can be used. Again the regular steam box can be substituted for the perforated steam pipes if preferred. Larger machines, having three stretch rolls, double the steaming capacity and a large brush with two or three cloth contacts, are also built.

Gigging as it is carried on to-day has two considerations connected with the mere mechanical part of the work, which it is very important to notice. The first of these is the teasel, and the second that may be mentioned is the condition of the goods as regards dampness during the gigging. When a lot of teasels is received at the mill it should be stored in a dry place, where the teasels will not absorb moisture and become limp and useless. In making use of the teasel the two great points to be kept in mind are the mounting in the teasel slat, and the wear upon it after it is in use in the gig. The teasels must be set in the slat so firmly that they will stand all the speed and working about which will be brought to bear upon them after they are in the cylinder. There must be no open spaces between them, and they must be as much as possible of one quality. Some advocate moistening the teasel before it is mounted, so that it can be the more firmly and easily pressed into place. In regard to the second point, the condition of the cloth in the process, there are the two questions of wet and dry gigging.

Where the cloth is gigged damp or wet, the fibres will naturally tend to lie down close to the body of the fabric, and when the piece gets to the shear the revolver blades pass over it and leave it much as the gig left it, at least so far as the bottom is concerned. The cause of this is found in the nature of the wool fibre, which more readily retains its position when damp.

The teasel serves to comb and lay the nap in a certain way, and when the shear gets at it, it is with difficulty that it touches it at all. In cropping, a wire raising brush, run a little faster than in the goods, raises the nap perfectly. The wetting of the goods is accomplished by means of an ordinary sprinkling can, or by a series of perforated pipes, so arranged as to eject a stream of water at the proper time and place. It is in this way that such goods as doeskins and beavers and some kinds of worsteds, etc., are treated, and it is the distinguishing feature of many of the finest finishes in the market.

By the method of dry gigging a different kind of finish entirely is produced. The fibres being dry do not retain the position which they are given by the action of the teasel, but have a tendency to stand up in their natural position. The teasel points get down farther into the body of the goods and thus work up a fuller and richer nap, and leave it in such a condition that the blades of the shear can readily reach nearly all the fibres. None of the fibres are lying down close to the weave of the goods and there are none of them that cannot be brought into contact with the shears by the use of a hard brush, which every shear contains. The character which this treatment gives to the finish may be described as a close, threadbare or clear face finish, the nap as raised by the gig being in turn cut off short by the shear.

Clear face goods, many classes of dress goods and worsteds and fancy cassimeres, are as a rule finished by means of dry gigging. In both cases, whether for wet or dry gigging, care must be taken not to push the cloth too forcibly on the teasels, for a tender piece of cloth will be the result. The teasels should be started slowly and gradually and the oldest and softest teasels should be used first, and then the sharper ones as the work progresses. There is a certain limit for gigging, to go beyond which is harmful to the strength of the cloth. To give to all pieces of certain styles of goods the same kind of treatment will in a great many instances result in failure, for although some of the pieces will finish perfectly, others will

be spoiled. Therefore in order to perform gigging intelligently it is necessary for the finisher to study the construction of the goods carefully. He must see what kind and amount of gigging each individual piece may need or is able to stand. Always remember during gigging to closely examine how well the felt is raised, as well as the strength of the cloth, so that no tender cloth will result. The slats must be carefully watched in order that the several grades may be kept at a uniform sharpness, and the teasels in the slats used completely up. It certainly will be understood that the teasels as used correspondingly change in their gigging properties.

When testing the goods under operation for strength, take both your hands and pass the cloth between the forefinger and thumb of each hand, having the thumb on top and bringing the hands close enough together to have the finger ends touch each other, then hold the cloth tightly between the fingers and bring the knuckles of the thumbs together, being careful that the cloth does not slip between the fingers. In this way you will readily ascertain the strength of the cloth under operation. It is a well-known fact that by means of this procedure by some practice you are able to burst the strongest fabric. Of course it is not at all necessary for you to do this; simply strain the fabric gradually and you can easily note where there is a tendency for the goods to part. Always test the goods near the end, in order that if a hole is burst in the cloth, the damage done will be a small expense to the mill. In order to ascertain the amount of gigging given a piece of goods, insert one of the small blades of a penknife under the nap, and lift and lay back the fibres, in this manner exposing the ground. You can then easily tell if all the fibres are raised or if some of them still cling to the body of the structure. Never take the cloth from the gig until thus tested with reference to its strength and more particularly yet regarding the nap being sufficiently raised. Then there will be no trouble at the shear, and goods will not have to be sent back to be regigged. In considering the desired finishing effect, it is apparent that a cloth which is to have a fairly long nap need not be gigged as deeply as one which if possible is to be steam lustred several times and then sheared short.

Melton-like goods require only a little superficial gigging, while, on the other hand, doeskins, kerseys and that kind of goods are to be gigged very thoroughly, in view of the subsequent operations. With goods destined for wear, like uni-

form cloths, in which attention is paid more to their strength than their elegance, gigging must be restricted to its minimum. In many classes of face-finished goods it is necessary to crop down the nap during the gigging process. That is, the piece is taken to the cropping shear and the nap is partially sheared off, so that when the goods are run again on the gig, the teasels can get down well into the body of the felt. This more particularly refers to heavy weights. In gigging kerseys for a water finish, it is a good plan to gig very slowly, and as much as possible one way only, since these goods as a rule are of medium to low grade, and therefore the material used in their construction is usually not of the best felting quality. For this reason make the felt that is there go as far as possible toward producing a good face, a good plan being to gig somewhat moister than would be advisable in other cases, since the less moisture the goods have, the more easily the fibres are pulled out. For the same reason, do as little reversing as possible, so as not to lose any fibres on that account.

A worsted finished piece of goods does not require much fulling, only as much as the goods may felt during scouring in the flannel.

All worsted cloth that is to receive a finish that requires gigging should be taken from the washer to the steaming and stretching machine and rolled up to give it a smooth face, free from wrinkles and streaks. It should stay on the rolls from two to three hours. At the gig it is absolutely necessary to begin with old work. After this old work, add a few slats of a sharper grade of teasels in the cylinder just before the operation is completed.

To obtain the lustre required on worsteds, it is necessary to gig all one way, and to use only a fine class of teasels, or there is danger of making the goods streaked and consequently not satisfactory. The use of napping machines in the finishing of woolens and worsteds has long passed the experimental stage; in fact, they have for the sake of production as well as a saving in labor become a necessary adjunct to the finishing room of any mill.

It used to be considered an established fact that nothing could successfully take the place of the teasel point, in the gigging or napping of face goods at least, but with the indisputable evidence before us, we must admit that this is no longer wholly true, and undoubtedly there must be some decided point of merit in these machines, otherwise their adop-

tion would not be as universal as it is now. However, it is a question if gigging by means of teasels will ever be wholly abandoned, for it must be remembered that the teasel gigs are with us and will continue to be used to quite an extent in connection with certain kinds of goods. Such an absolute uniformity of the working surface as is found in a napper is certainly never attainable with the teasels, no matter how closely we may watch them and try to keep things as they should be. The efficiency of the napper being constant and known to the operator, it will be readily seen that any piece of cloth run through the machine will get practically the same amount of gigging as another piece, provided the application of the fabric to the action of the workers is not varied, and the number of runs given equal to that of the first piece. On clear face finished goods and where it is an object to clear out the face and do it quickly, nothing can in any way surpass the efficiency of the napper, for one run over the machine will do more good in the direction of clearing out the face than any number of runs given on a gig. The different speeds at which we are enabled to run the workers of the napper, as well as the goods, and the ease with which the contact of the goods with the workers can be regulated, make it possible to produce almost any desired finish required by means of the standard makes of nappers in the market. If slow napping is advisable, all we have to do is to reduce the speed of the workers and if we want to nap fast, we simply have to increase the speed of the workers to the desired point of efficiency.

In the boiling process, the goods after proper gigging, and also a thorough wet brushing on the wet brushing gig, are tightly wound on wooden rolls at the latter machine, a burlap or canvas cover being wound around this roll of cloth and the ends tied. A number of these rolls of cloth thus prepared are then placed, by means of the protruding ends of the wooden rolls, in framings in a tank arranged in such a manner that the cloth of one roll will not come in contact with that of another, or with the sides of the tank. Two or more tiers of rolls of cloth are thus placed in one tank. After the tank is filled with rolls of cloth, water and steam are turned on, so that by the time the tank is filled with water it will be quite warm.

The tank is then covered and the water allowed to boil, and kept at a moderate boil as regulated by the amount of finish required by the goods, on an average of from four to six

hours, care being taken to keep the goods during the process always under water. The hot water is then drawn off and replaced with cold water, and the goods allowed to cool in this for from two to three hours, after which the water is drawn off and the rolls of cloth taken out and sent again to the wet brushing-gig and subjected to another thorough wet brushing, after which they are rolled up again on the wooden rolls for another boiling, being this time rolled in the reverse way from before, in order to allow both ends of the cloth to get the same amount of boiling. These two boilings, as thus referred to, go hand in hand. They form a process which must be repeated, provided once should not be sufficient for the finish required, giving a thorough wet brushing each time the goods are intended to go to the tank. Goods treated in the manner described will acquire a finish which is lasting, since the heat is slow and gradual, permeating the whole piece evenly, and by reason of slow boiling, the finish becomes set in such a way that it cannot be easily destroyed. However, it is too slow a process for large production in a mill, a most important item nowadays. The steaming machine takes the place of the boiling process now.

The object of this process is to force steam through the cloth for a certain length of time, and then cold water, until the goods are well cooled. As the action of the steam upon the wool fibre will bring out the inherent lustre of the fibres, one would think that this would be sufficient for the process of steam lustring a fabric; however, it is the action of cold water that tends to set the lustre which has been obtained by means of the steam passing through the goods. A great many impurities adhering to the structure of the fabric will be loosened and will be carried off by the water, thus leaving the goods in a practically cleaner condition than when they went on the machine. After winding the goods tightly on the perforated rolls previous to steaming them, a covering the same as that used in connection with the boiling process is wound around every roll of cloth, said covering being this time about two feet wider than the goods under operation, and of sufficient length to cover the rolls of cloth at least with three thicknesses. After this covering is wound around the roll of cloth, its over-lapping ends are fastened down on the roll by a strip of cotton cloth run spirally around the roll, and being finally securely fastened in order to prevent the covering from flopping when the force of the steam comes through the roll of

cloth. After this has been done, the steam is turned on and allowed to penetrate the cloth until appearing evenly on the outside of the covering. The length of time to keep up this process is regulated by the kind of goods under operation. About five minutes is a fair average time after the steam appears evenly on the covering. Then turning off the steam, the water valves are opened and a powerful stream of water is forced through the roll of goods until they are thoroughly cold. Some mills boil the cloth while steaming by filling the drip pans with boiling water. The steam and water pipes for this purpose can be easily put in by the user with no alteration in the machine. Boiling alone will not give a lustre so high or so quickly as steaming; besides, more or less unevenness is common to the boiling process. The brush is clothed with stiff wool fibre in order to lay the nap well, being for this reason also run at a high rate of surface speed.

For handling worsteds, and where the machine is more particularly used for setting them and freeing them from wrinkles, the brush, together with its application, roll mechanism, is not needed. During the drying, the goods under operation must be somewhat stretched in length and width in order to keep them smooth for the operations of shearing, etc., as performed afterward.

When this precaution of maintaining this smoothness at the drying machine is neglected, then the after processes will act upon the cloth in such a way as to make all uneven places and creases in the fabric past remedying, a feature which cannot occur when the cloth is kept properly stretched during the drying. The cloth should be dried from two to three inches wider on the dryer than the finished width required.

The object of shearing is to level the nap as previously raised by means of gigging, napping, or brushing on the goods, and this nap is of course more or less irregular in length, and has to be sheared off level to different lengths in different goods, to permit a certain finish required by the particular fabric under operation. In order to produce even and smooth work at the shear, before the goods are put on the machine, they should be again carefully back burled, an operation which consists in removing all bunches and knots in the goods which have been missed during the first burling of the flannel from the loom.

The operation at this point should be performed most carefully, it being advisable to use the burling irons only for the

raising of the bunches or knots, and then clip them by means of a pair of scissors. In removing the knots or bunches with burling irons, there is a liability of threads being broken, and thus damage may be done to the goods. As to grinding shears, see that the edge of the cloth rest is perfectly straight, and that it is kept so. Fit the ledger blade to the rest, not the rest to the blade. The shear cylinder must also be perfectly straight, and it must be of uniform diameter throughout its cutting length. A straight edge will show at once if the cylinder is high or low in the centre, but if it is tapering, that is, higher at one end than at the other, a pair of callipers only will show it. It is impossible to keep shear blades in good order without using a steel straight edge now and then. In starting up a new shear, or blades that have been refitted, first lay the blade frame, which has the ledger fastened to it, on the shear, then bring the cut of the ledger to the edge of the rest. See that it is perfectly parallel, that is, the edge of the ledger should come up as high at one end of the rest as it does at the other. Then take a piece of thin paper and slide it along between the rest and ledger blade, and see that it bears all the way alike. If you find any places that pinch harder than others, then use a fine file, taking off a trifle from the rest until it pinches all the way alike. However, only a very small amount should ever be taken off the rest in this manner. Should the ledger touch hard at both ends and be open in the centre, or vice versa, then try the straight edge on the back edge of the rest, also front edge of the ledger; and if the ledger is full at the ends and hollow in the centre, then grind the blades by laying in the cylinder and running it backwards, using for this purpose emery not coarser than No. 120, drawing up the ends of the ledger with set screws while grinding, but not the centre until it is brought up straight on the front side. If the centre of the ledger is full when you commence with it, then draw up the centre instead of the ends. After grinding, fit the ledger and rest together as before. When you have done this to perfection, lay in the cylinder and screw down the cap screws a little more tightly than can be done with the fingers. Be sure the caps do not bind too hard on the bearings, so as to cause them to heat. If they do bind, put some paper under the caps and screw down tightly. After running a few weeks they can be put down a little closer, and the paper can be taken out. Should the blades refuse to cut after running a short time, start the

upper set screws on the ledger a trifle, which will press them a little more tightly together. Sometimes when the blades do not cut near the end, the turning out of the conical-headed screw on that end just a hair will remedy the difficulty. If this does not remedy it, then lay out the cylinder, and with a hone held on the front side of the ledger, with the lower end out about one inch from the bottom of the blade, hone the edge of the blade thoroughly, then lay back the cylinder, turning it forward by hand, to cut off any feather edge that may have been turned over the hone. You are now ready for shearing again, and many times this will be much better for the blades. Always have the blades run as lightly as possible, that is, press the ledger to the cylinder as little as you can and have it do the work. If your blades rattle, slacken the ledger a trifle at the ends; sometimes honing off the bevel of the ledger at the ends will remedy the trouble.

By careful and skillful attention to the foregoing directions, shears may be kept in good order without grinding for some time, but if they have been in use for a long time, and the ledger is worn down and the bevel becomes long, it is advisable to grind the shear cylinder together with it.

For this purpose all the flocks should first be cleaned from the cylinder, and then the list motion detached and the vibrating wheel taken off, as well as all the belts, except the cylinder belt. Every part of the shear which is likely to be hurt by emery should be well covered.

Loosen the screws that bind the box which holds the cylinder to the frame, then turn the screws that hold the box up to the ear, say once around, which lets the cylinder down a trifle; then tighten the box again that holds the cylinder and commence to grind. With reference to grinding, a good mixture may be made of equal parts of No. 120 and flour of emery, mixed with a good lard oil to a thick paste, and when the grinding is nearly completed, finish up with a mixture of flour of emery and oil. When the proper mixture is made, you should have what is called a fiddle, about four inches wide, made by having a piece of wood four inches wide by 20 inches long, and putting cleats on 16 inches apart, leaving four inches for a handle and fastening some old four-inch belting to the cleats. Having previously covered up all parts of the machine, where needed, commence grinding.

Put your belt on with a cross instead of straight, so as to run the cylinder backward, put the paste of emery and oil on

the fiddle and apply it to the cylinder from one end to the other, and have your cylinder all through the grinding operation vibrated by hand. It is good policy to change the place of beginning to apply the fiddle each time a fresh supply of emery is applied, as that part is sure to get the most grinding, and in this way things can be kept nearly even. Run for about fifteen minutes, then tighten up all top rows of screws a little. Remember not to grind longer than absolutely required, since grinding takes the life out of the blades.

Keep at it slowly in this way and watch the front of the ledger blade to see how evenly the emery comes through, as that is a good way to see how evenly you are grinding the cylinder. Grind until the shear blades cut wet tissue paper all the way across. As soon as they cut evenly all the way across, take out the cylinder, clean it from emery and oil, and also the ledger blade. Now use a hone and rub lightly on the ledger blade at a 20-degree angle, to remove feather edge by grinding, and finally finish honing by running the hone straight across from end to end. Wipe the ledger blade after honing and replace the cylinder, bringing it about 1-32 of an inch forward, so as to take a little away from the heel of your bevel. Put on the belt and run the cylinder backward for about ten minutes, so as to polish the blades and insure smooth running, using for this purpose oil. Take out the cylinder and wipe all clean, using for this purpose sawdust and a whisk broom; also hone the ledger blade slightly, put back, put on swab and you are ready for shearing; but do not force the machine to take off too much nap from the cloth at once. Keep your blades well oiled and never run them when they are noisy.

In shearing a piece of goods do not have the ledger blade too high or above the cloth rest, as this will injure the cloth, and if the selvedges are poor, the shearing arrangement will cut them; also every little knot or bunch on the goods will be cut off. Draw the frame, holding the cylinder, down so that when the last notches have been reached, there will be a slight tremble, or jar on the cloth, caused by the cylinder touching it lightly, which action will not be perceptible when the piece is finished. This applies only when shearing woolens or cassimeres, while for worsteds the cylinder should not be allowed to touch the cloth, as it is liable to injure the threads. It is impossible to lay down hard and fast rules for regulating the amount of cutting to be done by the shear cylinder, the class

of goods under operation regulating the practice. For example, with a full, heavy nap, the blades would have to be set higher than where the nap is found short and thin. The lowering and raising of the cylinder, as the occasion requires, must be carefully done, for, if too much nap is being taken off the cloth at once, the flocks will soon show by being thrown in front, and the cutting effect of the shear will be very quickly impaired. For light-weight meltons, cheviots and suitings, which require but little shearing, the machine may be run with the blades set as low as is required to finish the goods with one or two runs.

On goods having a nap, like beavers, kerseys and broadcloths, the blades should be raised, so that but little of the nap will be cut off on the first run, and lowered gradually, until the piece is sheared as closely as required. Care should be taken not to lower the blades too fast, since this would cause them to pull, instead of cutting the nap properly. In connection with these goods it can be noticed that the nap is getting thicker, the shorter it gets. This is due to many of the shorter fibres being raised and not being exposed to the shear blades in former runs, when the blades are set low enough down, in order to cut the nap as closely as is required. The goods should get several runs at this point to insure a clear and even nap. Much of the difficulty met with in shearing these face-finished goods is due to work improperly done in the processes of finishing before shearing, such trouble being frequently caused by having the goods improperly scoured and gigged, which, if done as it should have been, would have permitted them to be sheared perfectly.

When shearing piece-dyed goods the whole number of pieces in the lot must be sheared the same, because if one is sheared closer or faster than the others, there will be a difference in the shade of these goods. The shear tender, on account of its being impossible for him to carry in his mind exactly the appearance or shade required of the fabric to be sheared, should always be supplied with samples of the styles of cloth he has to shear, being careful to shear to match the respective sample as nearly as possible. On account of a variation in the weight of nearly all goods, the variation in density of the nap, also the variation in yarn and cloth during its manufacture, it is impossible for the finisher to give his shear tender rules for shearing to depend upon, either as to closeness of pile or number of runs to give the cloth, etc. The use of correct samples

to shear by and the exercise of good judgment on the part of the shear tender only can produce good results. In the matter of uniformity of shade in connection with case goods, much depends upon the careful work of the operator. Not that shearing can change or regulate the shade as relates to the colors, but in the clearness with which the colors are brought out by shearing, and the effect of the light upon a long or short nap, together with the prominence of the threads or pattern, the shearing may result in what would be termed in the market a variation in shade or off shade. In many cases a slight variation in fulling, the density of the felt resulting in turn in a corresponding density of nap, will render it necessary for the shear tender to give the goods in question an extra notch or run or two on the shear, in order that the pattern may show up as clearly as in the sample.

Another important matter for the shear tender is to see that the two sides of the cloth shear exactly alike, so that each in turn will shade alike. If there is any variation, he must discover it at once and correct it before the piece is sheared down to the final notch, or there will be trouble.

The two sides and the middle of the cloth should be compared and must be kept uniform and the shearing made to compare with the sample as nearly as possible. After shearing, the pieces should be specked, and the girls should be very careful not to pick holes in the goods. Be sure and have the specking irons sharp. On some goods you can cover the specks with a pencil or ink. Now have them fine sewed, which is to sew in the places that have been overlooked by the coarse sewers. The purpose of brushing is to clean out the body of the goods from any dust, dirt, loose long and short fibres, and at the same time, in connection with face-finished goods, to lay the nap smoothly and evenly all over the surface in one direction.

Polishing or pumicing imparts a lustre to the face of the goods, rounding out each thread and giving it the full, rich finish that can be accomplished in no other way. The pumicing cylinders are sixteen inches in diameter, and have iron heads with six arms upon which the lags are mounted. The cloth, when applied to a broken cylindrical surface of such large diameters, receives a heavy beating effect and vibratory motion. This limbers and softens up the cloth and produces the fine velvety feel that is so desirable. These polishing or pumicing lags are set with alternate rows of the

stiffest Russian bristles and fibrous whalebone, with an adjustable steel supporting blade on each side of the lag. This blade prevents the breaking down of the outside row of bristles and whalebone and greatly increases its durability; it also gives adjustment for wear. For tightly woven and stiff goods, polishing or pumicing is unequaled by any other finishing process. Although primarily designed for finishing plain and fancy worsted and all hard-faced goods, it is now used in a more general manner on flannel and light goods, golf cloth and many others. The cloth is next sprayed or dampened. The object of this process is to dampen, that is, condition the fabric either before or after pressing. It is very important that this dampening of the goods should be done evenly, uniformly, as well as thoroughly, for which reason the water must be thrown against the cloth in a very fine spray and yet with such force that it will penetrate into the structure. Now comes the pressing. This, as a rule, is the last process the goods are subjected to, previous to measuring, doubling and rolling, for which reason they must receive due attention by the operator, in order that the work may be done well. The object of pressing is to smooth the fabric, by means of ironing it, of all its wrinkles and folds, as well as to enhance its beauty of finish. Certainly with reference to the process, the same as with all the other finishing processes, various notions prevail and the kind of pressing required for a certain fabric may be frequently regulated more by the whims of the commission merchant than by the actual requirements of the goods.

There are two methods of pressing in use: First, the old-fashioned method of pressing the cloth in folds between press paper boards and heated iron plates by means of hydraulic presses. To this process some manufacturers may still cling, in connection with some face-finished goods, like kerseys, beavers and uniform cloth, claiming that by this process the heat permeates the cloth slowly and consequently the pressing is set better. In some instances belt power is used in place of hydraulic power. Again, pressing by means of electricity in place of heated plates is practiced. Second, the modern steam-heated rotary press is used, which, besides doing perfect pressing (and this is as good as by the hydraulic press), gives a considerably larger production and a consequent saving in labor, time and expense to the mill. Sometimes the goods refuse to run properly through the press, that is, wrinkle

up badly, in some instances the press grinding parts of the cloth, a feature which may have for its cause several things, the most important of which is the dirty condition of the goods. Again, certain colors, on account of the dyestuff used, may be the cause of it; again, imperfect speck dyeing may be at the bottom, especially if the latter is made with sumac and iron, whereas if made with logwood, blue vitriol and soda ash, as it should be, this trouble is not likely to occur. Then, too, the trouble with reference to wrinkles may rest in the machine. It may be caused by the cylinder, which from running for any length of time under heavy pressure, especially if dealing with poorly scoured goods, may become smooth, and in turn refuse to carry the goods as it should, causing wrinkles, besides pulling the goods out of shape. In such a case, the goods will also have to be wet out again, and after drying, etc., re-pressed. If this occurs, scour the cylinder, a process technically known as rusting the cylinder, which is done in this way: After the press is cold, apply muriatic acid with a brush, then let the press run with all the weights off for a little while, say about twenty minutes, seeing that the cylinder is evenly wet. Then wash the cylinder thoroughly, turn on steam and clean up. The muriatic acid may be used either in its full strength or diluted, according to circumstances. Be careful not to touch any other parts of the press than the cylinder. Although brass is not affected by the process, yet it is a good plan, after drying the cylinder, to pull out the brass bed jackets and thoroughly clean and polish them, and then return them to their proper place, when the press is ready for work again. Be careful to clean the cylinder after this operation for a few days in the morning before starting work, since on account of the process it will be full of rust after standing all night. After the goods have been pressed and steam brushed if so required, they are ready for final examination previous to getting them in shape for shipment to the market.

In most mills the goods are inspected before they are sent to the press, since in this way, if the finish is in any way lacking, there is a chance to have it remedied, and not after the goods are pressed and ready to be sent to the market. When the pieces are thus inspected before pressing, in many instances faults can be corrected. After pressing and inspecting or inspecting and pressing, as the case may be, the goods are measured and in turn rolled in order to bring them in a shape for shipment to the market.

After the goods have been properly wound in a roll, they are placed in the cradle of a special beam scale and weighed.

A special scale is required, for the reason that it is necessary for us to thus ascertain at a glance the weight of one yard of cloth in the roll of cloth weighed, expressed in ounces. The compound sliding weight to use for sliding on the scale beam is made up according to the number of yards in the piece. After weighing, the piece is ready for wrapping in paper and shipping to the market.

# WOOL CARDING.

### ESSAY NO. 43.

The process of wool carding must necessarily begin in the picker room. It is very hard to make good work from wool improperly oiled and mixed. First, the wool should be spread in layers and each layer sprinkled with the proper amount of emulsion. Different kinds of wool require different amounts of oil. If the wool is coarse and wiry, or has been carbonized, it will take a little more oil, usually about five quarts to the hundred pounds. For finer wools that have not been carbonized, four quarts are sufficient. This oil should be made into an emulsion by mixing the amount of oil for each one hundred pounds of wool with eight quarts of water. A little sal soda or borax can be added, when the oil and water will readily mix.

This emulsion should never be put on the wool at a temperature above lukewarm. If it is, on some kinds of work it will cause electricity in the card room and prevent good results. It will also require more of the emulsion on the wool in order to get the proper lubrication for the carding process, also more labor and soap to get the goods clean in the finishing room, and will cause a bad odor after the goods have lain in the case a while.

The reason for this is that every wool fibre is hollow, and the emulsion, put on hot, immediately penetrates to the hollow place in the centre of the fibre, thereby lessening its lubricating effect, and becoming very hard to remove by any amount of scouring.

This oil remaining in the fibres causes the bad odor in the

goods after it is shut up in the cases. If put on at the temperature named, the oil remains on the outside of the fibres, giving the lubricating effect for which the oil is intended, and is easily removed in the scouring process of the goods, thereby making it much easier for the dyer to get good, even colors.

When the batch is all spread and the emulsion all on, a pole should be used to pound the wool to send the emulsion evenly through it. In feeding the picker, care should be taken not to skim off the top of the batch, but to take it right down through the pile. Much harm can be done in an improperly arranged lint room. A long, narrow lint room is bad; the light stock in the batch will go much farther than the heavy stock, thus causing an improper mix. The mixing picker standing so that the stock enters one corner of the lint room has the same effect.

Now we will take the stock to the card room. First we come to the Bramwell feed. The comb that combs the stock from the spike apron should be set as closely as possible to the spikes without danger of hitting them, allowing always that the scale has plenty of time to fill before the stock is dumped.

The feed box of the Bramwell should never be allowed to run nearly empty, and then crowded full, as this will cause uneven feeding. The scale should be made as sensitive in tipping as possible. The stock on the feed apron of the first breaker card, each feed should be pushed close enough to the one before it, so that there will be no vacant places.

Now we take up the condition of the first breaker card. For all kinds of stock except shoddies the writer prefers 32 tempered steel wire for this card. All wire on the card must be ground perfectly true. In setting the workers on the first breaker, I prefer the first worker set with a 28-gauge, the second with a 30, the others with a 32. For a fancy I prefer a straight wire open set. The speed of the doffer on this card may be varied according to the work being run, usually 12 to 15 turns per minute for a 30-inch doffer.

The speed of the main cylinder should be about 90 revolutions per minute. If much higher than 90 it will have a tendency to throw too much stock from the card, and if much lower it will not card the stock out so well. The second breaker card, I prefer 33 wire, workers all set with a 32-gauge, and the speeds the same as first breaker.

Next we come to the finisher card. Here I prefer 34 tem-

pered steel wire, and the workers set with 33 gauge. If any of the modern feeds are used on this card the wire and setting of the feed end of the card are very important factors in good work. The wire on the top feed roll should be shorter than on the bottom. Then I prefer a short wire on the leader. If long wire is used on the top feed roll the stock will leave it in bunches and a long wire leader will take it in bunches.

The stock must be delivered to the cylinder evenly or it will not be so placed on the rings. There are times when running good work that the tube belt on the second breaker can be left off, letting the tube stand still, thereby making a softer end for the Apperly feed. This will prevent many bunches in the roving. When running Apperly feeds on this card, I prefer running workers backward; it will prevent much lumpy roving.

As the object in carding wool is to separate the fibres and lay them as nearly parallel and as even as possible in the several strands of the roving, great care should be taken to have the doffer rings set an equal distance apart; then they should be ground perfectly smooth, and to a good point.

Frequently there is trouble in getting the top and bottom spools to weigh alike. Sometimes a very grave mistake is made if the top spool is the heavier, in setting the top doffer farther away from the cylinder than the bottom. This will cause nibs in the roving, which will make rough and uneven yarn. A set of gears is provided with all apron rubs to speed either top or bottom faster when necessary, and it should always be used in preference to setting the doffer off. Care should be taken that there are no high wires in the rings. A high wire in a ring will make a twit nearly every time that wire comes round to the wipe roll. The proper speeding of the wipe roll and condenser has much to do with making smooth roving. These should be speeded with a little draft, but not enough to make fine places in the roving. For fine work, say 5 run and up, I would have the finisher clothed with 35 wire, except the fancy, which I would have 34 straight wire open set.

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The expression of "lukewarm" in my essay was intended for the limit of heat for wool emulsions, all chance for variation being left for the cool side; but to be more explicit in this information I would say that the temperature should be between 76 and 80 degrees F., but never over 80 degrees. There are

two things to be guarded against in the temperature of an emulsion: One is the amount of heat that will cause the oil to penetrate the fibres. The danger point here is 80 degrees. The other is in having the emulsion so cool that it will not properly spread over all the surface of the fibres. In most picker rooms the emulsion should not be cooler than 76 degrees. As many picker rooms are kept cool, there is a great danger of the oil congealing before properly spreading.

The best results can be obtained with a temperature of 72 degrees in the picker room. There should always be heat enough in the card room so that there should be no danger of the oil congealing. In cool weather, a few open windows in the card room will often cause bad work, as the cards will fill up more quickly, and necessitate stripping more often. Very marked effects of this will be seen by watching the variation of the roving between the top and bottom spools, for the doffer rings fill up very quickly on gummy stock, and as they do so, roving from the top doffer will grow lighter. Some mills use soap in their emulsion. This causes the same effect. The temperature of the card room, when running on wool, should not be below 72 degrees, and 76 degrees is better. These results are based on actual experience. I have made many thousand pounds of coated yarns for sweaters. Manufacturers do not wash this class of goods. Consequently oils put on in the process of manufacturing remain until evaporated. I have never known of any complaints from bad odor of goods when emulsion was applied in this way.

# WOOL SPINNING.

## ESSAY NO. 44.

The art of spinning at times requires considerable skill on the part of the overseer. He is expected not only to make good even yarn out of good even roving, but is at times expected to do the same out of uneven roving. This may be done if the different strands in the roving are all alike and the unevenness is not too great. If the mule is drafted right, the fine places in the roving will take the twist first, then the heavy places will draw down even with the others, and in that way good yarn will be made; but the drafting of the

mule for this purpose is where the skill of the overseer comes in.

For spinning warp yarn with 40 to 50 inches draft, the drawing-out scroll should be set so that the drawing-out rope goes very near the end of the scroll, say within one or two turns. This will give the mule carriage a slow, steady motion at the last end of the stretch, which it should have. Then if the mule is geared right, the yarn ought to be good.

Now, as to the proper way for gearing the mule for this class of work. I always make it a rule to gear the mule as slow as I can without pulling the yarn from under the rolls. For this class of work the tops of the spindles should be set a little below the centre of the bottom roll. If set too low, the yarn will pull from the bobbin and make heavy yarn near the top of the bobbin; and if set too high, there is great danger of making twits in the yarn. Twits can also be made by allowing the quadrant chain to get too low. Heavy yarn can be made by winding the quadrant chain too high; also by pushing the bobbin down below the top of the spindle, which is sometimes done when piecing up, or when there is insufficient packing to hold the bobbin in its place.

Filling for this class of work does not usually require to be drawn quite so hard; otherwise its treatment is about the same.

Spinning yarn for underwear is different in many respects. The yarn does not require to be drawn so hard. A soft, lofty yarn makes a much nicer garment. This can be best obtained, first by having a longer draft of roving, and then by not drawing too low on the point of the scroll, or gearing too low. For this class of work the spindles of the mule should be set lower, not above the bottom of the roll for wool, and for cotton one inch below the bottom of the roll. For shoddy the spindles should be set near the bottom of the roll. This class of work has usually nearly full draft of roving, and should have a small driving gear to drive the carriage out slowly. Care should be taken that the roving drums are not run so slowly as to stretch the roving between the spool and the rolls.

The proper tightness of the driving belt has much to do with the good running of a mule. If the belt is too slack it will often make twits in the yarn, and if too tight it will make kinks on the top of the bobbin. Sometimes when a belt is too tight, to counteract the bad effect the spinner will tighten the rim band. This is wrong and should never be done if the

trouble is in the belt, as it makes the mule run harder and shortens the life of the rim band.

## WORSTED SPINNING.

### ESSAY NO. 46.

When all the parts of a spinning frame have been put together, and the machine fitted up, and the belt is running, it is the easiest thing in the world to make worsted yarn, so some people say. They say, "Oh, all you have to do is to turn the shipper on, and get the ends up, and that is all that is required." But there are a hundred and one things that are conducive to making good or bad yarn. Take cap spinning, for instance. The speed of a cap frame should be 6,500 revolutions per minute for counts from 24s to 32s; that is, if the stock is of average spinning quality; for finer counts of yarn, of good stock, they can be run up to 7,000 or 7,500, and some spinners will run them as high as 8,000.

But it does not matter as much about the speed of the frame, as it does about its condition, as a rough cap, a snip on the edge of the cap, or a cracked pot eye will cause the end to keep on breaking, and no matter how good the stock is, or at what speed the frame runs, if there are one or two on one side, it will keep the girl constantly on the run, and nearly every end that comes down is the same. Time and time again, therefore, the girl has no time to clean, and consequently the rolls and carriers get "mucked up," for if there is a small lap on one of the carriers it will make the yarn uneven, as the roving has to pass over it, and that particular carrier, being so much bigger with the lap on, will cause the roving to rise higher than the other carriers, and then, the wood carriers swing all the time on the roving, causing uneven yarn, and if it is short stock, it will in many cases break; in the other cases it is the same end that is down time after time, until the lap is cut off. Great care should be taken in cutting laps off the carriers, for if the knife marks the carriers, it will be lapping all the time. Another point is to keep the machine well lubricated, especially the spindles and back rolls; if the back top rolls get dry they bind and go more slowly, which will cause the roving to run offside.

Still another point is to keep the spindle strictly plumb, with the pot eye in the wireboard. If it is not plumb, there will be a constant jagging on the end, which will be constantly breaking.

Then there is fly spinning. Flyers do not run as fast as caps. The common spindle runs as high as 3,000 revolutions per minute, but the rabboth spindle will run as high as 4,500. The greatest point about fly spinning is in putting proper washers on to regulate the drag, and keeping the spindle plumb with the pot eye, and the carriers and rollers clean, and the machine well lubricated. Ring spinning runs faster than fly spinning, but not so fast as cap. The ring will run as high as 6,000 revolutions for worsted; it might run faster for cotton. The spindle must be plumb with the pot eye, and in the centre of the ring, or, as in cap and fly, there will be a constant jagging on the end, it will cause the traveler to wear out more quickly, and the ring to wear on one side, which will spoil it completely. Great care should be taken with the travelers, as the yarn will wear a nick in them in time, and then it will rub the yarn up and make it all thick and thin.

So the only way to make good worsted yarn is to keep the machine in good order, clean, and well lubricated. How is this to be done? Anybody can walk up and down a room, and if he sees an end down, call the spinner's attention to it. But does he try to find out what is the cause of the end breaking? It is impossible for him to go and see every end that is down, but if the overseer, second hand or section hand had to go into an alley occasionally and piece up an end, no doubt in many cases he would find a rough cap, or a snipped cap, or a nicked top roll, or a carrier lap, or a small piece of waste between the back rolls, or a dirty cap, or the spindle out of plumb, or a cracked pot eye, or a small roving, and there are many other things which will cause the end to come down and make the girl more work, and produce inferior yarn.

Another great point in the making of worsted yarn is for the overseer to always be around, for "when the cat is away the mice will play." Some men have a habit of taking the morning paper with them and reading for half an hour, and when they come back they find everything upset. Then they begin to shout and raise a row with everybody. But that would not be necessary if the overseer made it a practice to be constantly around, as "an ounce of prevention is worth a pound

of cure." Another point is the management of the help, which is a great factor in any business. Some men like to show their authority by always bullying the help and making it very uncomfortable for them. Consequently they are always changing help, and many a time they are short of help, and have some machinery standing, and they never have a proper system. The best way to manage help is to be civil, as civility becomes everybody. Be just and firm. If any of the help make any bad work, or otherwise do anything wrong, tell them in a proper way. If they still persist in doing so, discharge them, and if they have had right treatment, it will not be long before they are around again looking for work, and they will have learned a lesson, and the others will have learned a lesson, too. The help should always be taught to have an interest in their work, and be made comfortable, so that they will go to the mill as they go home. There is no need to nurse the help, or coax them to work, but just let them keep their own place, as "familiarity breeds contempt."

Worsted spinning is one of the best jobs under the sun if it is properly managed, but if it is mismanaged, it is one of the worst. The only thing it wants is that a man shall have a pride in his work and keep a level head, and then he is bound to succeed.

## HOW TO GET A HIGH LUSTRE ON BROADCLOTH.

### ESSAY NO. 47.

It is nearly always the cry of the commission man that the broadcloths have not enough lustre. Some insist on a very high lustre, even on low-grade cloths. While the desired lustre can be easily obtained on high-grade cloths, it is not so with the low-grade ones.

To obtain a high lustre, gig or nap your goods, as the case may be. A wire napper is just as good as a teasel gig if used right, but you must start in easily with the napper, as well as with the teasels, to get the required result. After napping, take the goods to the shear and shear down as low as they want to be when finished; then take to the wet brush and give at least four runs each way in water; roll up and take to

the steamer. Run back and forth at least twice, brushing the face all the time and keeping your frictions on, so as to get it just as tight as though it were a solid roll. Then steam twenty minutes on each drum. Cool off and roll up on a wooden roll. Let stand at least twelve hours. After the goods come from the dyehouse, wet brush four runs, three runs in water and one run without water, and roll up. Let stand on roll till the next day, when they will be drained enough to dry without extracting if you have a good dryer; if not, take goods off the roll, fold even and put the piece in extractor, just as it is in the fold, one on each side, so it will balance. After drying, give two runs on steam brush, put on shear with raisin brush off. Leave your blade so it will nearly touch, and give two runs. This is to take off any long fibres that may have worked up on the face after the first shearing, but remember, do not disturb your nap.

After the final shearing, give as many runs on the steam brush as you can without getting it too narrow. Run on the press tail end first, face to the cylinder. Sponge off the face very lightly, and you will have a good lustre and a nice smooth feeling face.

## WOOLEN SPINNING.

### ESSAY NO. 48.

In the spinning of woolen yarns there are a great number of points to be attended to with a great deal of care, for what are wanted to make a first-class yarn are strength, elasticity and a good, smooth thread, and to get these results the most important points to be looked after are the drafting of the mule and the amount of twist to be put in the yarn. It requires no little care on the part of an overseer to prevent the making of uneven and defective yarns. To keep from getting these an overseer should see that his mules are well cleaned and oiled and also that they are perfectly level by having his rollers level and seeing that the roller beam is in perfect line. He should also have the carriage in line with the roller beam or rollers and have all the spindles in perfect line, and also have all the spindles at the same height from the rollers; for if the roller beam is out of line it will be the cause of the

mule running hard and of unnecessary breakage of parts on the mule and of the work on the mule. If the spindles are not in line and all at the same height with the roller it will be the cause of making both twitty and uneven yarns. The spinning of woolen yarns may be considered under four points: First, the delivery; second, the draft; third, the twist, and fourth, the builder and winding motions. By the delivery is meant the delivery of the roving from the spools to the spindles, and care should be taken to see that the delivery rollers are properly speeded, so that the roving will be at an even tension at all times, for if they are not properly speeded it will be the cause of unnecessary breakage of the work on the mule. Care should also be taken to see that the rollers and the carriage and spindles start in unison; for if the carriage and spindles start before the rollers it will cause twitty yarns. Again, care should be taken to have the rim band at a proper tension, so that the spindles will start with the carriage and rollers; for if it is slack it will be the cause of making spindle points, as the spindles will be slow in starting, allowing soft roving to wind on the top of the spindles, which will be the cause of more or less trouble in some other room.

The drafting of a woolen mule is what I consider the most important part in the making of woolen yarns on a mule, for right here is where good stock can be made into poor yarns. In the drafting of a mule care should be taken to see that the carriage is properly speeded with the rollers or that the rollers are properly speeded to suit the carriage and to have the proper wings on the scrolls for the stock you may be working and the length of the draft you may have on the mule. For if the carriage is drafting too fast, it will be the cause of making both twitty and lumpy yarns and also unnecessary breakage at the work. All draft ropes should be kept as tight as it is possible to get them, for if they are allowed to run slack the carriage will travel in a very unsteady manner and will be the cause of making both twitty and lumpy yarns. But if the ropes are at a proper tension the carriage will travel in a steady manner and the result will be a good, smooth thread.

Care should be taken to see that the proper twist is in the yarn, as too much will injure the elasticity, and too little will injure the strength, so that it is a most important point to strike the proper amount of twist in the yarn. There are several things that will be the cause of unevenly twisted yarn,

so care should be taken to have all the spindle bands at an even tension, for if some of the bands are of a larger diameter than others there will be unevenly twisted yarn. Another cause of uneven yarns will be found if all the spindles are not at the same height with the rollers, as the spindles that are set lower will allow more slack yarn to be drawn off when the mule is making the outward movement. Therefore, the yarn will be uneven, both in twist and size. The builder and winding motion are very important points in regard to the spinning of woolen yarns, as there is nothing on a woolen mule that will cause more trouble and waste in a mill than badly built bobbins. So care should be taken to prevent this by first having all the faller fingers and sickles at the same height from the top of the spindles; second, see that the builder plates, both back and front, are perfectly level and that the builder shoes are not worn in any way and also that the studs that travel on the shoes are not worn, and have all the tracks on the mule perfectly level. If these points are adjusted in a proper way there will be no bad bobbins from the builder motion of the mule. The winding motion is another factor in the making of a good bobbin on a mule, and care should be taken to have the quadrant set at its proper point. If it is set too far forward or too far back it will be the cause of badly built bobbins. The tension faller should not be allowed to rise over four inches above the top of the spindles when the mule starts to wind the yarn on the bobbins, and the tension faller should just be even with the top of the spindles when the faller changes at the rollers. Care should be taken to see that all the weight stands are clear of the floor when the mule is winding.

## KNOWING HOW AND DOING.

### ESSAY NO. 49.

Knowledge is one thing; making use of it is another, as is exemplified by the manner in which some of our loom-fixers work. In hanging and starting a warp, for instance, what fixer would not be insulted if you undertook to tell him how the harnesses should be evened, how the shed should be set the temples adjusted, etc. Yet how often do we find these

things right? What a difference it makes, too, in the running of the work, the production, the weaver's feelings and his wages! How often do we see a warp weaving with the shed dragging on the race at one end and half an inch too high at the other, or the shed so uneven that part of the warp is wearing on the race and part is high enough to throw the shuttle against the box at the same end of the loom.

Another important thing in getting a good shed is a proper arrangement of the stirrups on the jacks and an even tension of the harness straps; yet how often do we see these things deplorably neglected? The temples also bear an important part in weaving and even when they are set so they will not cut the filling against the reed or shuttle race or allow the listing to chafe out, there is still a way to pitch them that will make a great improvement in the beating up and general weaving of a warp and smoothness of the cloth.

Then there is the time of the shed and that seems to be a matter of dispute. I have seen men in pretty high positions in the weave room who differed about that, one holding that an early and the other that a late shed was the best for a certain kind of work. Now, all there is to it is that you have to be guided by the warp yarn. If the nature of the yarn is to take the picks easily and the weave corresponds, the shed should close sooner than if the conditions were reversed. New cloths with a little graphite or plumbago should be put on the beam heads before the friction bands are applied; it will not only insure evener cloth, but will materially help the running of the warp. The shuttles, too, should be looked after and the tips kept properly smooth and pointed, not only to prevent the warp threads being cut, but in case of shuttles meeting in the shed they are more likely to pass, and one or both fly out if the tips are pointed instead of blunt.

Now, what I have written is nothing new. It is a threadbare subject. Every fixer knows all about these things. Why doesn't he put his knowledge in practice?

# CARDING.

## ESSAY NO. 50.

The carder who is able to produce perfect roping that will make a perfect thread and a perfect bobbin at all times and of all kinds of stock is to be envied.

A card room is without doubt the one in a woolen mill that is responsible for the loss that is sustained to a greater extent than any other room, and as many young carders have entered the field in the past few years perhaps it would not be amiss to reiterate some of the old-established facts relating to carding as well as to present what we have found to be new.

A larger production and a better quality of yarn from a cheaper grade of stock are called for and must be produced by the carder of the present day if he will retain his title of skilled workman. At the present time we find that there are many calls for carders who are, as above stated, skilled workmen, to whom wages are being paid, that surpass those of a few years ago. Wool, cotton and shoddy is the combination of a great percentage of the woolen goods manufactured. These three commodities are presented in various percentages, with shoddy predominating. There are various grades of shoddies, wool and cotton that in an article of this kind it would be confusing to attempt to describe. Cheap would be the best word best adapted to the description. This does not mean that the best grades of shoddy, wool and cotton enter into the cheapest goods manufactured, nor does it mean that the cheapest grades of shoddy, wool and cotton enter into the higher-priced goods of this combination. It will be understood that the selling price of stock largely determines the selling price of the manufactured goods, therefore the carder is in a position to increase or decrease the price of yarn from any combination of stock given to him to manipulate, first by a thorough carding of the stock and making sound roping; second, by keeping the waste to the lowest point, and third, by the greatest possible production obtainable from a given combination of stock and size of yarn. Assuming that the carder has the fullest scope to manipulate the machinery in his charge (unfortunately in many rooms this is not as it should be), he will give his best endeavors to producing the desired results.

Now for a few words on preparing a batch in the picker

room. That this should be done rightly is very essential to success in the carding room, where a smooth yarn free from specks is desired. Both the percentages of wool and cotton being small, those stocks ought to be carded before mixing in the batch to insure success. First the wool should be thoroughly cleaned of burrs in a burr picker that is kept in as near a perfect condition as possible. The burr cylinder must be cleaned as often as required, and this is when it is nearly filled with all kinds of foreign matter that is in the wool. The brush should be properly set on the burr cylinder just hard enough to keep the points clear—this is in order that perfect delivery be obtained at all times; and the screen over the main cylinder kept clean and the feed as laid on the feed apron not too heavy nor run so fast as to give more stock to the main cylinder than the burr cylinder will take and deliver freely. This burr picker is a grand good machine if carefully watched and given time to do its work, but if not handled carefully, and if crowded too hard, great damage will be done to the stock that cannot afterward be repaired, in that the stock will be badly rolled and the staple broken, and bad yarn and poor work in all after processes are the result. Too much attention cannot be paid to this machine. Last but not least, the exhaust must be kept well belted and run in its proper direction, and the foreign matter, dirt, etc., beneath the main cylinder cleaned out as often as necessary.

Having the stock ready for the mixing picker, it must be thoroughly mixed, by making layers of one upon the other of the different kinds of stock and then broken from top to bottom as it is fed on the apron of the mixing picker. It should be run through the mixing picker twice. Proceeding the second time as in the first, in making layers, etc., and while the picker is running from time to time the stock should be pushed back to the sides of the stock or gauze room. This is in order to keep the stock well mixed, as the heavy stock will fall directly after leaving the picker, while the lighter stock will go farther back to the sides of the room. As to oil to be used, experience has taught that in the past we have used too much rather than too little. Usually shoddy as it comes from the shoddy pickers or shoddy mill has oil enough on it (and frequently too much) for all purposes. If these batches are made up before being colored, very little oil will need to be used. Water should be used in this instance to moisten the stock, but stock that is colored or not previously

oiled, such as wool, would require to be oiled, and experience has demonstrated that an emulsion is better than pure oil. This is best made with borax, using half water and half oil, with enough borax previously dissolved in the water to cut the oil. This will not gum or stick in the card wire and has a tendency to soften the harshest stock. About one gallon of the above emulsion is sufficient for one hundred pounds of stock, but more or less may be used as may be found necessary.

Stock handled as above described will be in prime condition for the cards. The condition of the cards must be the best, whether new or old. Iron wire is a back number in a card room with one exception—that is the fancy. Nothing in my varied experience is nearly so good as an iron wire fancy. For all other purposes nothing will equal tempered steel wire.

The first and second breakers should be clothed with 33 tempered steel wire, ground lightly and to a sharp point. The finisher should be clothed with 34 tempered steel wire, that is, the cylinder strippers, workers, doffers, the tumbler with 32 tempered steel wire. Fancy 33 iron wire wide set feed rolls should be on all cards, clothed with coarse duplex tempered steel wire. If the cards are on all-wool fine work, then the feed rolls of the finisher should be covered with 18 tempered steel diamond pointed wire. The description for setting and operating one of those cards will answer for both, except the first worker on the first breaker, which is of the most importance. Concerning this more will be said later on. The above description of wire is for cards that are working all-wool or shoddy and cotton that has been previously carded, and waste that has been thoroughly cleaned of all foreign matter, such as broken bobbins, scraps of leather, pieces of lacing, in fact, every bit of refuse we see lying around a room on the floor and in the windows, all of which finds its way to the picker room by being swept together and sent there. Right here a word may not be amiss on this subject of waste and its care and how to prevent the same. Like begets like. If the superintendent or manager will go through the mill several times daily and will not stop to pick up that bobbin, whether full or empty, and will not pick up anything he sees on the floor not belonging there, it is pretty safe to say he has no employe in his mill that will do so. But if he will exercise a little care he will soon find his overseers will try

to imitate him in this line and nearly all the employes in the mill will get workers, strippers, doffer and cylinder matter off the floors and out of the windows. Then it will not be found in the waste. Too much cannot be said on this subject, but I would advise anyone to look around each room and see how nearly right I am; or put your hand under the doffer on the first breaker, pull out some of the droppings and see if you cannot recognize some as having been on the floor or in the windows of some of the rooms in the mill several days before the batch was mixed.

Now where this carelessness is permitted, 33 wire will not stand up long on the first breaker nor will it on picked stock, that is, shoddy taken from the picker. If this stock is to be carded then the first breaker should be clothed with tempered steel wire, 26 pressed to 28, set in flexiforte fillet, two inches wide and wound on to all workers, strippers, doffer and cylinder with a breast, or if no breast, then a tumbler covered with coarse, duplex steel tempered wire. Set the card in the usual way, and when grinding do so lightly, and of the third stripper make a fancy. Of course in this case one worker will have to be dispensed with, but this small fancy will more than make up for the loss of the worker. Try it. Run this small fancy from the regular fancy and very fast. Experience will demonstrate just how fast it will be necessary to run it to give the best results. As before stated, the setting of a card covered with this wire will be the same as on finer wire, and the setting of a card is a very important matter for the reason that we are very liable to overdo it, and as we wish to get the full benefit of every worker, we must set them all as close as possible except the first worker, which will be set off about twice the distance of the others. The strippers on all the cards will be set with a 30 gauge. As they run faster they are liable to jar or spring and it is not deemed safe to set so close and is not necessary.

The workers on the second breakers and finishers will be all set as close as possible without striking the cylinder, but on the first breaker use a 32 gauge and before setting any card we must find the highest sheet or spot on the cylinder. To do this set the doffer as close as it will go to the cylinder. Try every sheet on the cylinder, and when the highest sheet is found make a mark on the edge of the cylinder that this high sheet may be found to set all the top work by. There are few cylinders in any card room that will not show a

marked difference between the highest and the lowest sheet. This is the point at which we are liable to overdo our setting, for if we set the workers to any sheet promiscuously, it will be seen at once that we have overdone the setting for the reason that we will be very liable to set some one or more workers to the lowest sheet. Then when the card is started up the highest sheets will strike this worker and in a few minutes destroy all our efforts by taking the sharp point of this worker and sheet and so raise the wire on the cylinder. That this trouble is soon transmitted to all the other workers and doffers is a calamity to say the least. This is a trouble that cotton carders are not familiar with, as the cylinders of cotton cards are iron and do not show high and low spots as do the cylinders of woolen cards, which are made of white pine and made into lags and bolted on. It will be seen that no matter how carefully we may turn and true this kind of cylinder, when we put the clothing on, either in sheets or wound on in fillet form, some one or more of these lags will sink or raise enough either way to raise the very old mischief if we fail to find these high or low places when we are setting the card. This is a part of our work that it pays to go slowly and very carefully with, as we all have noticed in the past how well the work came off a certain set of cards after being reclothed and ground; but alas, after running a couple of days this same work is spoiled, all from the fact that this high or low spot was not looked for; hence the disastrous results that follow, entailing a loss of time and production and damage to the clothing, sometimes beyond comprehending. The fancy is a factor in itself, and must be set and run independently of the other parts of the cards. Seldom do we find two fancies that work just alike. Usually there will appear some difference in their working, no matter how much care we take to have them alike. Therefore, we will proceed to set and run each fancy as is best suited to perform its duties. While these duties seem simple, it is sometimes very trying to get the fancy to perform them. The duty of a fancy is to raise or lift the stock on the cylinder in order that the doffer or doffers may take the stock from the cylinder in an even, uniform web. There are three distinct ways of setting the fancy. First, with a very thin gauge; second, by the sound, and third, by sight, and perhaps the safest way is to employ all three.

Set the fancy with a very thin gauge, moderately tight. Then start up the card and set in or out to suit, by the sound.

Experience alone will dictate just how this can be done. Then, after running a few minutes with stock in it, stop the card and look at the points of the fancy wire, using a good magnifying glass. It will be easily seen just how far the wire enters into the cylinder wire, and one-sixteenth of an inch is plenty deep enough for ordinary mixtures of wool, cotton and shoddy. But on all-wool the fancy will not require to run so deep on the cylinder; 1-32 to 1-64 will be plenty deep enough.

The speed at which the fancy will be run will depend upon its working qualities as much, if not more, than in the setting. A safe way to proceed in this matter is to run the fancy 12 to 10 inches of the surface of both fancy and cylinder. To do this, mark the starting point on the fancy and cylinder right where they both come together. Now, with a tape laid on the wire of the fancy, mark 12 inches and do the same on the cylinder, marking only 10 inches. Now turn the cylinder forward till the 10-inch mark comes in contact with the fancy. The card is supposed to be all belled and ready to start when this is being done. If both marks on the fancy and cylinder meet, then the card is ready to start, but if they do not meet then put on or take off, as the case may require, lags enough on the fancy pulley to make the fancy go faster or enough slower to make the marks meet.

After having completed this speed of the fancy, start the card up and run in the stock. Let it run ten minutes, then take off the feed gear and run out the card. If the stock seems to linger beyond a reasonable time, the fancy is running too slowly and it will need speeding faster; just how much can only be learned by the working of the same and the look of the stock on the workers. This is a very important part of carding and should be strictly attended to before the card is put in continuous motion. Now the pitch and setting of the wire, as well as its size, are very important factors and seldom will carders agree on this matter, each having his own idea, and of course each does good work. My experience has been that an iron wire 32 open set, either with or without a knee or bend in the wire (I have both straight and bent now running and I am unable to say I can see any difference in their working), is about the right fancy for the first breaker and a 34 iron wire on both second breaker and finisher. These will give as good results as any

I have ever used. The setting and speeds are the same in all instances.

Presuming that we have the fancy working rightly, we will proceed to set the finisher, and this rule may be safely followed on all the cards except the first worker before spoken of, on the first breaker. On the finisher we will begin with the tumbler. Set this to the cylinder with a 30 gauge and the leader into the tumbler just as close as it will run without striking the gearing fancy. On top of the leader-in set the wire into the leader-in about 1-16 of an inch and to the tumbler with a 28 gauge. The speed of this fancy ought to be 12 inches of fancy to 8 inches of leader-in. This will insure a free delivery of stock from leader-in to the tumbler and also keep the leader-in sharp and smooth, a factor that is very necessary here. Our next step will be to set the feed rolls. These must be set as near the leader-in as they will run, and the top roll to the bottom the same.

Now the strippers will not need to be set quite so close to the cylinder as the workers, but they must be set as close to the workers as they will run without stripping the workers. Set to the cylinder as close as they will run. This applies to all the cards. While it appears that we set our workers on all and the doffers on the breakers as close as they will run, we draw the line on close setting when we get to the doffers on the finishers, for the reason that if we set the finisher doffers so close we will not be able to make smooth roping without twists. This may seem strange, yet it is a fact, and the reason is that the stock will be embedded so hard in the rings that a free delivery is not obtainable, causing shives and other matter to stick to the rings and to a great extent causing twisted roping. Now to avoid this we set our doffers with a 32 gauge. This allows the stock to be laid on the surface of the doffer wire by the cylinder and allows it to be easily taken off by the wipe rod on the condenser, but of course the width of the ring and size and quality of stock have a great deal to do with twists, and as it is not within the power of the carder to change any part of this, he will use his best judgment when these conditions exist. But I will say without fear of contradiction that a narrow ring will make better roping and better yarn than a wide one. You will ask, How, then, are we to have a narrow ring if the card requires a wide one? My answer to this is, if the card is 48 inches, taking off strands of roping from 48 rings, take them

off and put on 60 rings. This will both give a larger production and make better roping and better yarn. If you are a doubting Thomas, and seeing is believing, try it on one set. The jack spools will need to be a little longer and the arms on the jack changed a little, but it will pay handsomely to make the change. This rule will apply to all widths of cards.

Now the setting of the rub rolls or aprons will require but little time, as the same rule applies to both. Set the wipe roll (previously covered with corduroy) with a 30-gauge to doffers and rolls and aprons with same to wipe roll. Then proceed with the rolls, one to the other in the same manner, and if aprons are used, they will be set the same. Then after starting with the rolls or apron running with a one-inch sweep or vibration, if the roping is condensed too hard, the rolls or aprons may be set apart a little, or the sweep shortened or the speed reduced, or perhaps all three, as may be required.

Assuming we have now our card all set, and having our feed heavy enough (this applies to all cards) to cover the feed apron without crowding, we are ready to start the card. We notice now every movement of the various parts of the card, and so far we find that the stock appears to be straightened on the workers, as it should be. If the drawing is too heavy or too light, we change the gears on the feed end of doffer to make the difference come right. It is to be assumed that all the belts are tight enough to run their respective parts without slipping, and yet not so tight as to bind, causing the bearings to get hot or run hard.

Now a word about the speeds of the first and second breakers. The same will do for both, and if we are only looking for quality and not quantity, then it is an easy matter to get the speeds, which will be slow in all instances. But quality is not all we desire; we must have quality and quantity combined. We must get both or go out of business. Our object with the stock in question (and but little change is necessary for all wool) is to card the wool and cotton as much as we can and yet do very little carding of the shoddy, as the less carding shoddy gets, the better for it. But as all three kinds go together, one will get as much carding as the other. Then our only alternative is to hurry the stock through the card. This we do by running our doffer (18 inch) 18 to 20 turns per minute, with a 6-inch pulley to drive the workers, and if we have pulleys at hand, the speeds of the workers should be different, running the worker over the tumbler, commonly

called the first worker, the fastest and the worker next the fancy the slowest, the other workers varying between each, running more slowly as they number from first to last. This applies to first and second breakers for finishers. In extreme cases we have a different arrangement for speeding and running the workers, which will be explained later on. In running this kind of stock it is sometimes difficult to keep the end up on both first and second breakers. On the first, a belt or carrier runs just under the comb, and toward the tube. The tube must have an outlet or hole of at least one inch in diameter, and be driven by a 5-inch grooved pulley, either on the shaft under the card or on the second stripper. If this twists the drawing too hard, place a small piece of tin close up to the tube and let the edge strike the drawing just before it enters the tube. This, by setting off or on the drawing, will make the drawing as soft as we may wish.

On the second breaker a roll of about 3 inches in diameter will be used in place of the belt, as used on the first breaker; otherwise it will be treated the same. Now we have those two cards arranged for cheap stock, but should we desire to return to fine or medium all-wool work, we will first reduce the speed of the doffers on both first and second breakers, also run the fancy slower and lighter, and the belt and roll under the comb will not be needed. The tube will be driven from the shaft of the main cylinder; otherwise we proceed as above stated. Now, to proceed with the speeds of the several parts of the finisher not already spoken of. The speed of the leader-in should be as fast as it can be run, allowing for the tumbler to clear it or take the stock from it, and also allowing the cylinder to clear the tumbler, as this is a point where a lot of mischief is done, such as bunches, coarse and fine ends in the roping. It is well here to explain some things that are not known and have caused much trouble. I refer now to a bad working leader-in. To be sure, we prefer a new one to an old one, but this is not always to be had, so we must make this old leader-in go. The trouble with an old leader-in is that it has got worn down until the pitch of the wire is lost; that is, they stand nearly straight, and so instead of taking the stock in a continuous web, it goes in in chunks and bunches, and when a leader-in gets into this condition, no amount of grinding or setting or speeding will make it right. We can help it, but we cannot cure it. Now to help a leader-in that is making bunches and uneven roping, take the leader-in out

and rewind it. Reverse from left to right, first pulling out four wires across the fillet and about nine inches apart in length of the fillet. This will leave spots in the fillet of about one-half inch. This will give the leader-in a better chance to nip the stock from the feed rolls, and then the bunches will not be so large. Just a word here—generally, such a leader-in running on all-wool will make very nice roping. The trouble arises when we run short stock with shoddy predominating.

To reduce those bunches is nearly impossible, for if we cannot get the stock into the card even, we will be unable to get it out even, but we may be able to reduce those bunches to a small factor by the manipulation of the workers. Then run the first worker, or that one over the tumbler, with a 4-inch pulley; the second at about the same speed, but reverse the third worker. Run with an 8-inch pulley in its natural direction. The fourth worker should be reversed and run very slowly. The fifth worker is run reversed, but a little faster than the fourth. It will be seen that by this arrangement of running the workers the lumps and bunches will be reduced to a minimum, but I will repeat that a new leader-in will save all this uneven work, and to monkey with an old leader-in is not profitable, to say the least. Again, it sometimes happens that a new leader will not take the stock from the feed rolls properly. This is because the pitch of the wire is not too straight, and the stock, instead of being taken properly, will roll and go into the card in bunches. This kind of a new leader-in should not be tolerated, for it will grow worse as long as it is used; but if it must be used, proceed the same as above described for an old leader-in.

To put on and run a new leader-in, it will depend on the kind of stock we are using to have it work successfully, and as before said, this is a very important part of our card—to get the work in even. Now if we are using all wool and making medium and fine yarns, a 24-tempered steel diamond point wire will be about right. I say about, for the reason that either 22 or 26 will give splendid results, but if we are using a low grade of stock then a leader-in of coarse duplex tempered steel wire set in one inch wide fillet will give the best results, and to prepare any kind of a new leader-in for successful operation first wind on as usual, pretty tight. It is presumed that the wood or iron it is to go on is perfectly round and true. Then set up to the grinder very lightly. This is only to grind off any long wires that may be found. Then get a pail half

full of picker dirt. This will be found on the inside of the cover and sides and arms of the picker. Mix oil enough with this to make a medium thick paste. Now crowd this into the wire by hand, then with a good stiff brush pound it in hard and smooth. This is commonly called flocking, but in this case there are no flocks used. When this is done properly, put the leader-in into its place in the card and set as before stated. Now I venture to say without fear of contradiction, that barring accidents this leader-in will run until worn out without giving any trouble, with only occasionally a resetting to keep up to the wear of the wire. We must be very particular with this part of our work, for here are made most of the troubles that follow from the finisher. It is a positive fact that if we cannot get out work into the finisher even we certainly cannot get it out even, although we may be able to help to do so with the aid of the workers as before described. Many troubles that are laid at the door of the picker room and dyehouse are made right here, in the form in which we enter the stock to the finisher. If the stock is allowed to enter the finisher in bunches great or small, just in proportion to the size of these bunches will the trouble show itself in all the after processes, and it will show its ill effects most in covert goods or in double and twist goods in the form of streaks, while in Oxford mixes and Scotch twist goods it will have an appearance as though the stock was not properly mixed. I do not wish to be understood as saying that all of this trouble belongs to this part of the finisher card, for stock that is harsh and is said to be burned either in coloring, scouring or drying will produce the same effect, although much more tender and twitty in the finished goods. Even if we have this part of the finisher in first-class condition, it will be seen that we must present the stock in as nearly perfect condition as our ability will allow. It will not work successfully with a hard twisted drawing. We must have the drawing as nearly without twist as possible. An Apperly feeder should be laid on the feed table firmly, but not crowded, with the latches or fingers well out, so the outside ends will not be bunchy. Having explained pretty thoroughly the working of the several parts of the finisher, we will take up the rub rolls once more. We shall see where a lot of mischief is very innocently done. As before stated, all the rolls should be set with a 28 gauge and the larger rolls (there is generally a marked difference in the size of these rolls) should be on the outside, varying to the smallest, which should be

next to the wipe roll. As the draft or draw between the rolls is of great importance, it follows that we should have the rolls in their proper place. Suppose, for instance, we put a newly covered roll under the wipe roll while the next roll is old and worn. We shall have very disastrous results, which will come very near undoing all our previous labor. The sweep or vibration should not be over one inch, and we may find that on very tender stock a shorter sweep may be much better.

As we shall have to run our doffer rather lively we shall have also to vibrate in proportion on this grade of work that we are filling up for. And we may say, barring the matter of speeds of doffers and rub rolls, the card will be in condition for any kind of work, except very long, coarse wool.

We will vibrate the rolls at about 130 turns per minute. Usually with this kind of stock there is more or less trouble from the ends or strands of roping running together. To prevent this, make a guide of flat fingers. Old shafts from loom harnesses are very good. Fasten to a piece or strip of wood, 7-8 of an inch by two inches, and long enough to reach across the card and to be fastened to the frame of the rub rolls and frame of the card and just under the rolls and between the same and the doffer with the fingers to come up between each ring and wipe roll. This will put a stop to the ends running together at once.

Now the speed of the doffers is governed by the work or stock we are working, and while we will try to run our doffers just as slowly as we can afford to in order to give all preceding operations a just share of the work to do and at the same time keep the belts on the tight pulley, we shall find that this slow speed of the doffers means that we are running some of those doffers above 30 turns per minute. While it is not my wish to convey the idea that all doffers can be run at this speed, I shall try to explain why it is necessary to do so and how I arrived at this speed on working of this cheap stock, and I am sure the reader will agree with me that it is no great thing to do, either.

By actual count we find that the speed of our doffers running at various speeds averages 26 1-2 turns per minute. In order to explain how we arrived at the above speeds it will be necessary to go back to the days of slower speeds. This will bring us to the period of the operation of the McKinley tariff. Our mill was then running on a grade of fine cassimeres into which a large percentage of fine Australian wool

entered, with no cotton and little shoddy. There was probably about 15 per cent. of the latter in backing in the heavy weights. Our doffers on our finishers were making an average speed of 16 turns per minute. With cards and doffers running to correspond with those speeds, we were able to keep our jacks, so to speak (mules and operators) and looms running on roping to correspond. With our stock, from 30 to 36 inches of roping was usually allowed for the draft of the jacks. This was drawn to 72 inches of spun yarn, barring the make-up allowed for twist. The backing was not drawn so much. Forty to 45 inches of roping were allowed on this, all depending on the stock and size of the yarn. As we had so little to do we thought we had a snap, and now I am sure I had. The try for free wool and cheaper clothing was not without its effect. We labored but in vain to protect and hold our snap. Finally our mill stopped. Then a start was made with a cut in wages that ranged from 10 to 20 per cent. We had seen our last fine or any other kind of Australian wool. Cheaper clothing was the order of the day. Little wool, little cotton, with a big lot of shoddy was the stock we got to make into yarn under the free wool idea. It was changing from one style to another, with wool diminishing in each style, and as each style advanced we were obliged to make our roping lighter until we were allowing 50 inches of roping to be drawn on the jacks to 72 inches of spun yarn. We had on this work our doffers running at an average of 20 turns per minute.

We then thought that we had arrived at the limit of high speed doffers, but this did not keep up, so we ran our cards through the noon hour and this did not fill the bill, so we went to the extreme of running our cards until 9 o'clock five nights a week. This kept up, but, and there is a but, the woolen carder who is obliged to run his card room overtime noons and nights to keep his spinning machinery supplied with roping to be converted into yarn has but little liberty or happiness. He is tied down to his employment all day and so far into the night that it is sometimes past bedtime before his work is done. He has no time to read his paper to keep himself posted on general affairs, no time to read a good book, no time to attend a good lecture, or a good entertainment, and as to a vacation, that is simply out of order, and the remedy is where? Let us see. We like to be like other folks, like to take a stroll in the evening and visit

and talk with our neighbors. Now it is sometimes, and I may say many times, our own fault. I must admit here that while my employer asked me to work overtime, he never asked me to work on Sundays, although I have done so on several occasions when I had a cylinder to cover and nail on. This is due to holding to some of the old-time ideas that good work cannot be made with high speeds. Of course there is a limit and we should reach this limit, and that at once. As we look back we find that we have had doffers running 16 to 18 turns per minute that could have been run at 26 to 28 turns per minute with but little extra labor added to start with and with no extra labor as far as the overseer is concerned, above attending the cards, which will run through more stock and require just so much more labor from the card tenders. It will be seen by the above that the overtime and running the noon hour will be a thing of the past just as soon as we produce more roping during the work day. Then we shall have some of the liberty and happiness the Constitution tells of but which is now so far from our reach. This is the predicament in which I found myself several years ago. It was run noons and nights or speed up. I preferred the latter.

We have seen how in a general way we have ground and set our cards and prepared them as far as forethought would permit, but of the hundred and one things necessary to accompany the work as it proceeds we will name a few and give a remedy, which we have found to be tried and true. To get an absolutely even yarn that will not vary in weight of a given number of yards of yarn taken from different spindles on a mule operator, jack or spinning frame, either wool, worsted or cotton, is an impossibility, and probably, from the system employed in a woolen card room, the greatest variation that will be found is commonly called unevenness. This is caused by a variety of things, which must be attended to if we expect to get the work as nearly perfect as possible. I would say right here that when I copy a new lot from the ticket on my lot book I note the number of the card this lot is to go on, and when this lot is on the finisher I make a note on the lot book of where the weight of or ball on the feeder is set. Then I also note what number of all the gears are connected with the feeding of the card, also note the sizes of the doffer and side drawing, pulleys and the gears on side drawing. This is done with all the set of cards, first and second breaker and finisher.

This I find to be of great value in starting raw lots of the same sized yarns and it will help at once to locate any change that might be accidentally made. Then it will show at a glance the shrinkage of any lot over another of the same composition by the different number of the feed gear used or weight of feed, and is a great time and waste saver, as from this record I am able to put on just as nearly the right feed on the feeder and the right gears on the cards, thus saving both time and waste. I would advise anyone who does not do this to try it, and I am sure he will agree with me that this simple idea is worth trying.

The cause of uneven work on the first breaker will be, first, the feeder; second, the gears or belts slipping; third, fancy winding; fourth, the card or any part being allowed to run when the whole card needs stripping, and fifth, allowing the bearings to get dry and waste in them, causing parts to run hard and get hot. All these things being corrected, there will be no further trouble. This same rule will apply to all the cards, only a little more on the second breaker. If creels are used on the second breaker, start the lot with one-half of the spools or balls full, the other half half full, and maintain this thus until the end of the lot. If laps are used, start with one full and the other half full, and so maintain till the end of the batch. There will be found several causes for uneven roping.

The feed on the feed table must be kept in as nearly perfect a state as possible, by having the drawing very soft and packed just hard enough to cover nicely without crowding. The other causes have been described farther back. Now, just a word on grinding. Always grind light, and to a sharp point, and if rings are to be ground, do it very lightly, and when ground finely enough, with a good magnifying glass examine the points of the wire. If a burr appears on the wire, set up to the grinder and grind pretty hard for five to eight minutes. This will knock the burrs off, and with a hand card filled with very coarse wool smooth the rings for a few minutes or until all the burr disappears from the point of the wire. This is one of the best methods I ever used. With a set of rings so handled, there will be no trouble from twists and ends sticking to the rings after stripping them.

And now a word on specks and how to card them out. When we put stock into the first breaker and it appears on the workers rough and not straight, there is something wrong, and nine times out of ten this wrong will be found to be in the

cylinder. Although we may have just ground or smoothed the same, this trouble will be invariably in the cylinder, and this will be that the pitch of the wire is gone and the wire stands too straight. A cylinder in this condition is not in shape to card any kind of stock, and no amount of grinding or smoothing will make it right. We must get the wire back to its original pitch. To do this, if the wire is not too straight, take the card apart in the same manner as would be done to smooth the same. Run the cylinder back and with a half round file hold with both hands, one at each end, and have the edge of the middle of the file come in contact with the wire on the cylinder pretty snug. Hold so it will ride smoothly and not jump. Just the right position will be found by varying the file from one position to another. This will bring the wire to its proper pitch, if it is not too straight. Of course it will be understood that this file must be run across the face of the cylinder from right to left, and vice versa. If the wire should refuse to yield to this treatment, then place the engine lathe on the fancy arms, and bolt tightly, proceeding just the same as though the cylinder was to be turned and trued. Now place a small flat file in the tool stock with the edge upright. This will give just the width of the edge of the file to work with, which will be about one-eighth of an inch. Now set the file into the wire and turn the cylinder back by hand. If it is in hard enough the wire will be brought forward to its natural position. Now start the cylinder to running back and move the file across the face of the wire very slowly. If the card was ground or smoothed before this operation, no further grinding or smoothing will be necessary. Care and good judgment must go with this operation, otherwise the cylinder may be spoiled, and its usefulness as a card will be at an end, for if the wire is brought forward beyond its original pitch, it never can be repaired. But if this is done carefully and properly, this cylinder will work very nicely, and will card out the stock beautifully.

# SOME POINTS ON CARDING.

## ESSAY NO. 51.

If some carders to-day were asked to make a set of rings they would no doubt throw up their hands and give up. I was second carder to an old carder who was placed in this position and had to make rings for a top doffer.

We took out the roll and drilled four holes on the outside of the roll on both sides for plugs, then wound on some No. 34 clothing as tight as we could draw it. Then the roll was placed in a lathe and he ran the blunt end of a tool that was the exact width of the bottom ring (fourteen-sixteenths of an inch) in the wire. He alternately jammed down and left standing the width of a ring. I forgot to say the doffer was run with the point away from the tool. When he had done this across the roll he tacked strips of fillet over the wire he had jammed down and he had a set of rings that answered their purpose very well on the stock we were using.

When working on cards that are hooked up with self feeds and on fine work I contend that the weight on the beam of the weighing pan on the first breaker feed is so heavy that it is more or less guesswork to change for two or three grains.

By fastening a hook on the beam of the weighing pan and putting on or taking off washers for the purpose, you can change for a very small variation.

At one time I was working in a card room that was making yarn for a cotton worsted. We were using dyed wool in the batches. The work in the card room went along finely until one lot started the opposite. All the cards were sharp and smooth, still there was a tendency to curl or roll up. The next day this same batch on the same cards went along all right and all the curling vanished. The next lot we started went the same. The wool was of a long fibre, but it would not card out. We then found out that the dryer man had stripped the dryer about the time a batch was started and the picker man had taken this wool direct from the dryer to the batch instead of using what had been dried the day before.

After we used the wool that had been dried the day before we never were troubled with that feature any more.

# SCOURING AND FULLING OF WOOLEN FLANNELS.

## ESSAY NO. 52.

The scouring and cleansing is a very important part of the finishing processes through which all kinds of woolen goods must pass, and on its being properly done depends the success of operations and treatment to which goods are afterward subjected. With modern machinery in which the top rollers of washers are driven by gears and held down by springs, the process is very much more certain than it was in the days when the top roll was driven by friction and held down by a lever and weights. Then it was difficult to tell when the soap was all out of the goods and we used to hear a great deal about uneven coloring and greasy smelling goods. There is very little of this kind of trouble these days, comparatively speaking, and what there is can be wholly avoided if the machinery is kept clean and everything in good working order. In speaking of washing machines, I have in mind those carrying four strings of goods. There are larger machines, and machines built to handle goods in a special manner, all of which have merits in one way or another, but the principal and final end to be obtained is to get the goods freed from dirt and grease and from the soap used in the process. In nearly all cases where goods develop a greasy smell after finishing, it is the result of soap left in the goods. The best all-round machine for mills of moderate size and making several classes of goods is one carrying four strings of goods, fitted with a gate at each end emptying into a sewer deep enough to carry off the suds and water quickly.

The gates should fit tightly so that the soap will not leak out and go to waste. They should be kept free from rubbish. so that when opened the suds and water can get away freely. If from any cause the gates get out of order or the sewer becomes clogged so that water is not carried off freely, there will be trouble. It is just as important that particular attention to cleanliness should be observed about a washing machine as in any other process, but I am sorry to say it is not always done. In too many cases the washing machine is placed in a dark corner, often underneath a line of shafting. the bearings of which are left to drip down grease, which often finds its way into the machine and to the goods, and if

anything in the world will cause a man to swear, it is continually finding grease spots on the goods. To do work properly the machines should be placed where there is good light, with ample floor space all around, so that a man can pass between machines in perfect safety. The floor should be laid so that water will drain off quickly. A very common source of grease spots is the bearings at each end of the washer. These ought to be cleaned regularly and systematically and oiled carefully, not too much at a time, but just enough, and often enough so that bearings will not get hot. In every wash room there should be a length of one-inch hose connected with a water pipe in which there is pressure enough to clean the inside of the washer from soapsuds before taking out a set of clean goods, otherwise the suds will drop on the goods and make spots. A great many do this by throwing in buckets of water, but this is a laborious and sloppy way and nearly always unsatisfactory.

The foregoing remarks in regard to the placing and keeping clean of washing machines will apply to the care and handling of fulling machines. Supposing that a man has good machinery, properly located, and is supplied with appliances for preparing his scouring soaps and other necessaries in proper quantities and convenient form, he can go ahead and do his work without worry, with less hard work and with more satisfaction all around than he could under less favorable conditions. In regard to the quantity and strength of the scouring solutions no hard and fast rule can be laid down, as a great deal depends on the kind and condition of the stock from which goods are made. Then the quantity and quality of the oil put on the wool before carding will have an effect. Where pure lard oil has been used goods will clean more easily than where mineral wool oils have been used. Soap made with a potash base is best in most cases for both scouring and fulling, because it is more easily washed out of the goods, and if not used too hot or too strong, it is said to leave goods softer than when a soap made with a soda base has been used.

In scouring flannels which need no fulling except what they will naturally get in the process of washing and which are to be piece dyed, the following plan has worked well. When goods are in the machine turn on warm water, set the machine going and run ten minutes. Shut off the water and let them run a few minutes to drain. Close the gates and throw in enough soap to raise a good lather. If at the end of twenty

minutes the lather is still good, it indicates that there is soap enough and that the dirt and grease have united with the suds. You may open the gates, turn on the warm water to help get rid of the suds, run a few minutes; then shut off warm water and turn on cold; rinse twenty minutes. Then shut off cold water and warm them up again for a few minutes; rinse again with cold water for five minutes and the goods will be clean. Where the water is hard and in very cold weather, a very good way is to treat them with fuller's earth in the following manner, immediately after the first rinsing with cold water: Have a vessel that will hold two or three barrels of water, throw in three or four buckets of English fuller's earth and stir it well, so that the water will carry plenty of the earth, and with the gates of the washer closed, throw in several buckets full of the fuller's earth and water or enough so that the goods will be thoroughly saturated. Let them run for ten minutes, or longer if need be, then rinse off with cold water. If this solution is used warm in very cold weather it is the most satisfactory. This is a good way to treat piece-dyed goods from the dyehouse, when soap cannot be used or when a rinsing with water will not clean them sufficiently. In scouring goods made from carbonized wool treated by the acid process, it is a good plan to rinse them with warm water for thirty minutes before putting in the soap; it will save a great deal of soap.

In scouring fancy flannels in which there are three or four acid colors liable to be affected by soap so as to cause them to run and stain the portion which is white, a good plan is never to allow either warm soap or warm water to touch them during either washing or fulling. By using cold soap in both fulling and scouring and treating them with fuller's earth in the washer after the soap has been well washed out, the goods will be clean and smell clean and the colors will look bright. Fuller's earth used in the way described here is very useful and can be made to effect a great saving in time and soap, as well as insuring clean goods. Fancy flannels should be extracted as soon as possible after being taken out of the washer.

In the treatment of ladies' dress goods, light and heavy weight broadcloths, and, in fact, all goods which require a great deal of fulling, and whether they are wool dyed or are piece dyed, it is better to scour them and dry them before putting them in the fulling mill. A closer and better felt will

be obtained than if they are fulled with the dirt and grease in them. If there are not drying facilities to permit this, put them back into the fulling mill after they have been washed and extracted as dry as possible. Use a soap thick enough to compensate for the water in the goods. Another way is to put them into the fulling mill without scouring them, soap them up well and wet and let them run until the dirt and grease are well started. Then take them out and extract as dry as possible, put them back into the mill and give them just enough of a heavy-bodied soap. Don't get them too wet. This is a rather dirty way, but sometimes it is useful. It is a good way to treat some kinds of low-grade goods which contain a large per cent. of shoddy and wool extracts. They will full more quickly and closely and will not waste so much in the mill. Soap for this purpose should be at least three degrees in strength, Beaume test. All goods which require a good deal of fulling and have to run for several hours should be shaken out and overhauled often enough to prevent mill wrinkles. Sometimes goods woven with a plain weave, if allowed to run too long without being overhauled, will get felted together in places, often causing a damage. The next step after the goods are fulled to the proper width is to get them freed from the soap used in the process. The heavier the goods, the more care must be used. Put the goods into the washer and if they were scoured before fulling there is no need to add soap at the start. The object now is to get rid of the soap already in the goods. Start the machine and shut the gates. Let in enough warm water to start the soap, then after they have run a few minutes, let out the suds; repeat this until you are well rid of the soap, then add enough of a thin soap to bring up a good lather, run fifteen minutes and wash off, beginning with warm water and finishing with twenty minutes' rinsing in cold water. Then if you have any doubts about the soap being all out, warm them up again for ten minutes, or treat them to a dose of fuller's earth and rinse again.

In the manufacture of the finer grades of white wool blankets success depends very largely on the care taken to bring them out a clear, pure white and free from specks and spots. The oil used on the wool should be of the very best quality. Goods should be finished up as soon as possible after they are woven. Wool intended for high-class goods should not be scoured very long before it is going to be used, and should be dried in the open air if possible. Scour and dry the

goods, if possible, before fulling them, so that all burrs, specks and spots may be removed. When ready to full, use a white soda soap of the best quality; 25 pounds of soap and 5 pounds of soda ash to a barrel of water will make a good solution. As blankets full easily, the top roll of the fulling machine should not be held down by the springs more than is necessary to steady it and keep the driving gears together. It is not a good plan to shrink them too fast. To free them from soap after they are fulled enough, put them in the washer and let in enough warm water to start the soap and loosen it up well. Ten minutes' run is long enough for this purpose. Then wash off the suds with lukewarm water for about five minutes. Then lather them up again with a weaker solution of the soap used in fulling, run ten minutes and rinse with warm water until it runs clear. Ten minutes in cold water will finish them. If they are to be treated to an acid bath, now is the time to do it. Always use fuller's earth if there is any doubt about soap remaining in the goods. There is nothing to beat it, and in some cases it is indispensable. Every machine and everything with which these goods come in contact should be kept scrupulously clean.

The persons handling them should wear clean clothes and always keep their hands clean when handling the goods. There should always be a sufficient supply of white cotton sheets with which to cover them. Goods treated in this way will look nicer and smell sweeter than sulphur bleached goods. If this class of goods can be dried on tenter bars in the open air they will be whiter than if dried on a steam-heated machine. The use of a soda soap in fulling will bring the goods out whiter than when a potash soap has been used. Too much cannot be said in favor of using fuller's earth as described in this article, and it is about the only way in which it is of any use in the fulling and scouring room.

## DYEING OF LOOSE WOOL.

### ESSAY NO. 53.

In the dyeing of loose wool at the present time we have a large variety of dyes to choose from. Many of the diamine colors are fast to milling on wool, and many of them are so

fast that they can be safely milled in goods containing cotton. In dyeing loose wool with the diamines the bath is prepared with from 10 to 20 per cent. of Glauber's salts with acetate of ammonia. On some shades it is not necessary to use the acetate. Enter the stock at about 50 degrees C. Bring to boil in about thirty minutes. Boil one hour, then exhaust the bath with from 3 to 5 per cent. of acetic acid, adding slowly. The after treatment can be done in the exhausted bath with blue vitriol, bichromate of potash or chromium fluoride with the addition of about 2 to 3 per cent. of acetic acid. Then there are the acid alizarine colors, which, when properly used, are fast to milling and can be safely used in goods containing cotton. They are very good on the very lightest of colors, such as pearls, fawns, drabs, light slates, blues, pinks, etc. In dyeing loose wool with the acid alizarine colors the bath is prepared with from 10 to 20 per cent. of Glauber's salts and the necessary amount of dyestuff and from 3 to 5 per cent. of acetic acid. Enter the stock at about 50 degrees C, bring to boil in about thirty minutes. Boil for thirty minutes, and shut off steam. Add slowly from 1 to 3 per cent. of bichromate of potash, according to the depth of shade wanted, and from 2 to 4 per cent. of sulphuric acid. Bring to a boil and boil one-half hour longer. If the shade is not just what is wanted, the necessary amount of dyestuff can be fed into the same bath. When very bright light shades are wanted, the same amount of chrome alum can be substituted in place of bichromate of potash, leaving the shade clearer and brighter. Sometimes we get a very bright shade. In many cases where the goods do not take too long a fulling and scouring a good fast aniline color is all that is required. There is quite a line of these colors in the market, such as the milling reds, yellows, blues, greens, etc. Also the formyl violet and blue acid violet, the patent blues, fast acid violet R, mordant yellow O, as well as the different styles of one-dip wool colors. There are also the chrome colors, that work on a chrome mordant as well as after chromed. And from all these we get a line of very bright and fast colors. Then there is a line of colors that work well on a chrome mordant.

A number of these can be used with the regular alizarine colors and they make very fast colors that are fairly bright. The mordant bath is started with from 2 to 3 per cent. of bichromate of potash and from 1 to 3 per cent. of oxalic acid. For very bright colors 1 per cent. of ground alum will improve

the shade. Boil from one hour to one hour and a quarter. Draw off this bath and start the dye bath with about 10 per cent. of common salt and from 3 to 4 per cent. of acetic acid and the necessary dye. Enter the wool moderately cool and bring to boil in from thirty to forty-five minutes. If the bath is not exhausted at the end of an hour's boiling, feed in from 2 to 3 per cent. of acetic acid. Extract of fustic, extract of logwood, alizarine and the regular chrome anilines can be used together in this process with good results.

Some classes of dyes will not give good results if the water is hard. The water should then be softened with oxalate of ammonia, using from two to six pounds of the salt to 100 gallons of water, according to the hardness of the water. There is sometimes trouble in getting even colors when there are two or three different grades of wool in the same bath.

When it is possible it is well to run stock through the mixing picker, which gives good results, or when the picker is not available, it is well not to use any acid until the bath has been boiling for some time. The acid should be fed in slowly to get the best results. If it is necessary to feed on dyestuff, as is often the case to get the shade required, the dyestuff should be thoroughly dissolved and well diluted in water and put on slowly to get even colors.

## RUNNING A CARDING AND SPINNING ROOM.

### ESSAY NO. 54.

One of the first things that requires attention in a carding and spinning room is the mixing of the cotton. There are many ways to do this, but the one that has given me the best results is to have as many bales as can be conveniently mixed together in one pile. Then when filling the hopper, carefully take off the mixture from one side straight up and down. This will give you some of all the grades together. The hopper must be kept three-quarters full at all times. The reason for this is that if the hopper be allowed to get empty it will certainly cause light laps and uneven work all through the mill. Nearly all mills in these days require you to work the waste over that accumulates all through the process of manufacture.

In doing this, extra care should be taken not to put any waste under any consideration in this mixture. While a great many do this, it is a wrong way and should not be allowed, for it is quite impossible to get good yarn when it is done.

The waste should be returned to the hopper in proper condition, the same as you do the good cotton. In making laps, put two on the doubler with two good ones. Take one off the doubler and put on the finisher with three good ones. This will distribute them evenly. But if thrown on the mixture, or put in the hopper carelessly or at random, there will be difficulty in getting it properly mixed. The laps should not be allowed to vary in weight more than one-half a pound on the doubler and one-quarter on the finisher. Try to keep the evener belt running in the centre of cone as nearly as possible. Do not allow the picking machine to run too fast. Some mills allow the picking room to run in four or five days what the card will do in six. It will be found, when this is done, that the yarn will be dirty and uneven, for the card will be trying to do what the pickers ought to have done.

This part of the mill should receive more attention, and I can say without hesitation it is one of the most important departments about the mill, and a good careful man should be selected for this position.

Starting correctly generally ensures good work at the conclusion. He should see that the machines are well cleaned once a week at least, and careful attention should be given to prevent too many laps getting ahead of the machine, as they are liable to get torn when pulling them on the apron. Never allow four laps to be put on at once, for if the apron be a little slack, the weight will cause it to slip and uneven work will follow.

Another important thing should be seen to, and that is that the draft trunk that leads from the fan has nothing to cut off the current. I know of instances where sprinkling pipes have been put in and allowed to run through the trunk or in front of the outlet, so that the fine fibres that escape with the current will accumulate on any obstruction and thus shut off the draft. This will cause uneven laps and give that mackerel-sky appearance so often complained of.

# WORK IN THE CARD ROOM.

## ESSAY NO. 55.

The work accomplished in the card room of our mills deserves a tribute. The carder must not only be a mechanic, he must be a thinker and able to judge and understand conditions. His work broadens him if he is properly constituted, and he is, moreover, many times prevented from attaining his best by the narrowness prevailing in our smaller mills and the ofttimes useless red tape of the larger. He generally starts his mill life as a youth, successively doing the work of tender, stripper and second hand, and by the time he has reached the years of discretion he has mastered the detail of the carding process and the work of the room in general of the particular mill in which he is engaged.

When he becomes overseer, his views must broaden; in the new classes of work and conditions which he will have to contend with each season he must use judgment and foresight.

He should be able to control his help, and where labor is scarce he should be able to attract them, and get their best work cheerfully.

When the plant in which he is employed increases, or he moves to a larger field, he learns that he can no longer attend to everything himself, he must depend on others, and here is the severe test of a man's character and capabilities, the test which shows whether he is fitted to stand amongst the foremost in his line of work. The time has come when he must impart his knowledge to others, in fact to multiply himself in his seconds in command; not to make it easier for himself, but that he may accomplish more, and he must be able to use system as a servant and not look upon it as merely red tape. He must be the man at the centre and learn that he can accomplish more, with moderate effort, than the do-it-all man, who strains himself to the utmost. The penalty of trying to carry all the load is that instead of his helpers becoming men on whom he can rely, they remain boys, who lean on him, in place of being able to take a share of the responsibility.

It is of course the same in a degree with the overseer of any other department of mill work, and we have chosen the carder, in that he is the man of whom, of all the overseers in a mill, are required the keenest judgment and skill. He starts the ball rolling, and on his ability to get certain results from certain

stocks depend the designer's ability to get up fabrics at a salable price, the superintendent's ability to get results in perfect cloth and large production, the firm's ability to compete at a profit, and the smooth running of the work in the succeeding departments after it leaves his hands.

The carder himself should realize what depends on him, as should his superintendent and fellow-overseers and workers, so that all may work together for the highest attainable results, and thence for their own well-being.

## WOOLEN SPINNING.

### ESSAY NO. 56.

In the spinning of woolen yarns the machine is required to be in proper shape just as much as the stock to be spun, for no matter how good the stock may be or how much pains the carder has taken with it, if the mule is not in proper shape and every part of the machine in good working order and drafted right, the results are not apt to be satisfactory.

The writer at one time had a little experience in that line in a Western woolen mill. The mill at that time had eight sets of cards and ten Johnson & Bassett jacks and light pattern mules of 1889 make. They were running on fine yarns, from four and a half to nine runs. They had just gone off heavy weights and they were having trouble with their fine yarns. The ribbers were full of fine places and the yarn when it came from the mule was more so. The superintendent informed me that all of their stock was sorted and he could not see, for his part, why it did not spin and look better. He also stated that his carder was a new man and that he himself was looking after the spinning, with the help of a young fellow who had had a little experience at fixing and drafting, his spinner having been gone about three weeks, and as near as I could find out he had had three different spinners in a very short space of time and one carder, and yet his work was not coming any better.

I thought I would go down and look the mill over and have a talk with the carder. I found him to be a very smart appearing man and, as I found out later on, a first-class carder. He showed me the different stocks that he was running and the

weights of the ropings that he was making. He also showed me the one that they were having the trouble with. It was a steel mix warp and filling of 36 grains, of 50 yards. They were, in fact, having trouble with it all, but more so with the finer yarns. I had just got through looking over the different wools when the superintendent showed up and seemed a little surprised to see me talking with the carder instead of coming back to his office. He wanted to know if I had been in the spinning room yet, and I informed him that I had not, so up we went to the next floor. The spinners were mostly girls, and I want to say right here that they are all right if the work is good and no ends come down. They will sit down on their waste box all day and chew gum; but give them something that they have got to hustle on and they are simply not in it. I did not blame some of them much for not doing anything on some of that work. It was something awful, especially the 36 grain. The ends would simply drop, but I noticed that they broke a great deal more when the mule had been stopped and was started again. I also saw that the threads on the first three doors on the ends were down all the time. I just looked that mule over a little and made up my mind that I could improve on that spinning immediately, and when the superintendent asked me what I thought about it I told him I thought it would be a very good plan to stop the mule. He wanted to know if I thought I could help it, and I replied that I could. He wanted to know in what way, and I told him by having my own way. I had found out that he bothered too much in and around the different rooms for his own good. He informed me that he had drafted that mule and that he had the roping made where he thought it ought to go. I asked him where he was having his roping made and he said at 32 grain. I told him that I would like to have one set of roping made at 39 grain and be sure and not have it made any finer, and I would look that mule over in the morning. He gave the carder orders to that effect and I could see a pleased look come over that carder's face at once. That was the beginning of the end of the bad work on the fine all-wool work. That was the starting point. That evening I looked up the carder and had a talk with him about the work, and, in fact, everything in general. I asked him if he did not think that there was altogether too much oil being put on in the mixing room. He agreed with me that it was better to have a little more wool and not quite so much oil. It would, he thought, work better,

and he would speak to the superintendent about it the first thing in the morning and see about having him cut it down one-quarter of the amount, and if it was any better he would try and have another one-quarter taken off. Of course there was a limit to the quantity that must be taken off; he would find that out later. The next morning I was down at the mill very early, but the superintendent was there ahead of me. We went up to the spinning room and I told him that I should break off that roping and fix up that mule, and when I got ready to start it I should put on the roping that the carder was making for me, and that he had better tear up what he had on spools. He said to pack it up and he would see later on what he would do with it. That roping was still "packed up" when I came away. I told him that I would let him know when I got ready to start the mule. That was the last I saw of him that day. I got my tool box open and went to work on that mule. I told the second hand to keep right along just as he had been doing until further orders. I looked that mule over, and the first thing I did was to level up the rollers, and then I sent down after the machinist and had him put new keys in the rollers. There was a back lash of nearly one turn of the rollers at the end. If there is one thing on a mule that will cut fine yarn it is that. The next thing to do was to level up the tracks. I found the centre track loose on three of the stands that the track holds to; the bobbins showed it by having a hole in them. I next ran the carriage up to the rollers and cut off the packings on the first four spindles on every section. I then got my spindle gauge and set it over the centre trucks and raised the carriage up to about one-third of the bottom roller, and worked toward the ends, and then came back and went to the other end, making sure to start from the centre every time. I then reversed my finger on my gauge and raised my follow rods upward toward the spindles until my wire would clear the point of the spindle, and then worked from the centre to each end, raising every follow stand; that brought my carriage and follows up level with my rollers. I then set my bumpers so that my spindles were just 1 1-4 inches from the rollers. I then pulled my mule out and back of the wire and pushed in the carriage until I set the trip on the floor and then I went to each end and set the studs that press down the tension wire. Those two should work together, both the tension wire and the trip on the floor that unlocks your follow, to avoid three or four slack turns at the nose of the bobbin. The next thing to do

was to draft it. I put a 52 gear on the centre drive on roller, tightened up my chains—not too tight; if you do, it may cause your draft clutch on top shaft to stick and may cause long and short draft and light and heavy draws. I then put on 17 driving gear, better known as draft gear, and then looked over my draft scroll and found it open full width. I closed it up tight and found a lot of play in the key on the scroll shaft and found that the carriage let go at the end of the stretch with a snap. I simply turned the key end for end. That held the gear back and let the clutch open all right. I worked the cam over and found the escape lever and rocker shaft were all right, but the driving belt was altogether too tight. I put in a piece. I then went and tried my shoes and found the front shoes were dropping a little too fast, which caused the bobbins to head up at the top. I found that the front shoe had been filed. I filed the pitch on the back one so they would drop both ends of the rail together. I then set my backing-off chain in the centre of the carriage in the top hole, so it would back off a little more slowly, to avoid cutting off the ends. I then slacked up my rim band just a little to lighten the running of the machine. In the meantime I had taken the speed of the spindles and found that they were making 1,600 turns to every draw, so I set the twist again the same. I got my spinner and put in the set of roping that the carder had made. This was the next morning. In the meantime the superintendent had stopped the card to avoid making a lot of roping to be torn up. If he should see this, I hope he will forgive me, for I long ago forgave him for giving me that job.

I got the roping in and ran the machine out and pulled the scroll down as far as I could, so as to draw very slowly when the roping stopped and to smooth up the yarn on the end of the draw. In the meantime I had looked over the roping and found that the twists had gone. The carder was the more pleased of the two. That spinning simply sailed right along. The trouble was that the ribbers were too fine, and the mule was too fast and all out of line. I sent down after the superintendent; he came up and I think to this day he felt sorry to see it go so well.

He cut down his oil on everything and it went better, all through the mill. That is where a great many superintendents make a great mistake. They seem to think that the more water and oil they put on, the better it will go. They don't stop to think how much finer the carder and spinner have got to make it.

# FINISHING WOOLEN AND WORSTED GOODS.

## ESSAY NO. 57.

I do not intend to give any formula or formulas for finishing woolen and worsted goods. All the articles so far in this competition have done that in almost monotonous detail and no doubt others will follow. What I wish more particularly to deal with are a very few of the many difficulties that are constantly arising in the best regulated and equipped finishing rooms, and that after the most careful attention to every detail has been given to the work. I believe there is no part of the mill work where coolness and good judgment, backed up it may be by experience, are more called for than in the finishing process. A lack of any of these requirements will often spoil all that has been previously done in the process of manufacture. The finisher, then, should have a good head and have the good judgment to know just what to do to get a desired result and finish when things do not turn out as they should with the regular treatment. I believe any finisher of experience will bear me out in saying that such conditions are pretty numerous. Of course in an article of this length I cannot mention the many, but will confine myself to one or two of the more common that are met with.

The first one is in getting the goods up to sample.

The sample blankets, ends and pieces are put right through as soon as they are woven of course. A close tab is kept on them as to how they are treated and every detail noted in order that the goods may have the same treatment during the different processes. Now unless we keep in mind the fact that the yarn of which the goods are made or the goods themselves may have lain around in the grease for weeks, and as a consequence are not in the same condition as were the samples, we strike trouble right at the start, because goods that have lain in this way for a length of time become set and are harder to clean, keep bright in color and to give that snappy look and feel that is so much desired in the finished fabric. Any piece of goods that is not perfectly clean and entirely free from oil and dirt of every description cannot be properly finished. It will look dead, feel flabby and all the rescouring and doctoring in the world will not make it as good in finish as it would have been had it been properly cleaned

in the first place, and right here comes the first, and I believe the greatest, difficulty in a finisher's experience, so I will emphasize this one point. Be sure and get your goods clean and all the later difficulties during the finishing process will be of minor importance and will be much easier to overcome. There are a great many formulas for fulling and scouring but I will not give one, only saying that for fulling use a good heavy-bodied soap with proper proportion of alkali so it will not during the process become watery. It will in that case take the very life out of your goods, or again do not have an excess of alkali, as the result of that will be a burnt, harsh feel almost impossible to rectify. For scouring worsteds or goods that are not fulled use a lighter bodied soap, but one that will keep alive until it has loosened all oil and dirt and at the same time not injure the color or handle of the goods. Any finisher of good judgment and experience to back it can soon remedy any fault at this, the most important, stage of the finishing process, and when you have a perfectly clean piece, about 75 per cent. of the further difficulties are discounted. That they will be there all along the line goes almost without saying, even to the end, for there are the manifold operations of crabbing, steaming, gigging or napping, shearing, brushing, pressing, all having their difficulties, of which I have not space in an article of this length to speak. Some of the best mills are now doing their own sponging and shrinking. An article could be written on the difficulties of this alone, for it is very important that the goods be uniformly shrunk and sponged so that the clothier and cutter can be given satisfaction.

## WOOLEN AND WORSTED WARP PREPARATION AND WEAVING.

### ESSAY NO. 58.

Woolen and worsted warp preparation is of so much importance that it would not be just to refrain from writing of it. There are many inconveniences in the weave room which the dressing and spooling departments are wholly responsible for, and the result is sometimes imperfect cloth, and bad work. I have had many years' experience in this line of work, and

think I know what I am writing, having observed and taken record of the many faulty evils that most of us meet from day to day. To commence with, proper warp preparation is one of the essential points in obtaining good results in weaving.

Woolen yarn with a great amount of twist should be steamed a little before being spooled, as it will cause trouble in kinking on the spoolers if the yarn is not steamed properly. Friction must be used on the yarn to remove some of the kinks; care, however, must be taken that the yarn is not strained too hard or it will break in spooling, giving trouble for the spoolers, and at the same time causing holes in the spools. Every spooler should by all means have a stop-motion attachment that when in working order stops instantly. When a strand breaks, a spooler's knot should always be tied when spooling worsted or woolen yarn, and care should be taken that a gooseneck knot is not used. The latter will cause no end of trouble for the weavers. When a plain weave is in play, the weft almost invariably curls or kinks on these knots.

After the yarn is spooled, it is taken to the dressers and placed in racks. After a pattern is picked, the different colors are tied in to correspond with the draft layout. Care must be taken that colors are arranged regularly so as to give uniformity in the dressing process. This system must always be carried out.

When the colors are tied they are then run in separate reeds, namely, the pattern reed, leice reed, and sley or nock reed. The latter must be much coarser than the former, and carry more than one thread in split as the width of the section calls for.

Always have sections the same width so that the yarn will sley on your reel evenly, thus giving even sections when the warp is done, and avoiding section stripes.

Warp compressors are to my knowledge very handy and useful machines for beaming warps, and ought to be used in every woolen or worsted mill and on every warp, whether it be two or ten cuts. Not only do you get 25 per cent. more yarn on the beam without straining, but the yarn will, when weaving, come from the beam more uniform. Very little friction is used on the reel when the compressor is in use. Just keep your yarn tight enough to avoid lagging, and your compressor will do the work, and you will find you can beam your yarn without a strand snapping, as it often does when you are without a compressor and a friction reel to get the

yarn on the beam and have it hard laid. I have often seen reels where a compressor was not used. The appearance of the reel was worse than the Western Union telegraph station. That is, when the yarn had been beamed off on to the beam, the strands that broke when beaming would go around the reel a turn or two extra, thus giving the reel the appearance of a net. A warp that is wretchedly dressed and broken by extra heavy tension on the reel in the beaming process will cause delay in the weaving, and lessen the production, eventually making the cost of the manufacturing very high. Not only does the beaming cause this trouble. When the cloth is made up of several colors and during the dressing process the tension is not regulated on the spools, there are tight and loose threads running from section to section, and when it comes to the weaving, these tight threads will bury and break, giving the weaver trouble, and the loose threads show too prominently, spoiling the effect of the pattern, as it will not have the same appearance as the original, and the defect cannot be remedied to any extent in the finishing process. The loose threads can be drawn tight at some expense to the manufacturer. The tight ones cannot be helped in any way, and are a detriment. A superintendent or overseer should watch these little things, and none but first-class men who thoroughly understand these important facts should be employed in dressing.

Weaving, whether considered from an artistic or mechanical standpoint, is unquestionably one of the most important processes of cloth manufacturing. Other operations are of only secondary importance, having for the object the preparation of the raw material for the loom, or the improvement of the appearance, handle, and surface of the woven product.

On the process of weaving depends to a very considerable extent the success of manufacturing in general. The employment of good, sound, even yarn cannot possibly result in the production of satisfactory goods if the motions of the loom are in any wise defective. The worsted power looms of to-day are a great advantage to the manufacturer of fine grades of worsteds and woolens and a godsend to some loom fixers, certainly improving the appearance of a weave room. A casual analysis of the mechanism of the new loom of to-day is sufficient to convince any one of the completeness, symmetry and uniformity of its various parts. As a mechanical invention it

may justly be classed with the foremost productions of the human mind.

Just a few words as to fast running looms. When the mechanism of the loom is improved so as to be right in principle, as the new looms of to-day are, high-speeded looms are a great advantage to the manufacturers in obtaining production and good cloth, and a great benefit to the weaver. But to take looms fifteen or twenty years back, as I have seen done, and try to run at a high speed is no gain, but more often a loss to the manufacturer. The mechanism is not adapted for high speed and you will find in the long run that you will have broken picker sticks, shuttles flying and smashes, and in time will come to the conclusion that you cannot trot a three-minute horse in two minutes. That a loom can be made suitable for producing all classes of goods, such as light stuff fabrics and heavy overcoatings, is totally impracticable. Experience has taught both the loom maker and manufacturer that the weight and construction of the loom must correspond with the strength and thickness of the texture it is required to weave.

For fine worsted fabrics or good woolens made of good elastic yarns a quick running loom is of great advantage. The order in which the various motions of the loom operate in relation to each other is as follows: First, the shedding apparatus begins to raise and depress the warp threads when the going part or lap touches the cloth; second, the picking motion begins to drive the shuttle across the web when the going part is half its complete traverse from the cloth, or when the crank is at the bottom; third, the weft is driven home by the forward movement of the reed as the shed closes; fourth, the piece is set up and the warp let off simultaneously with the beating up of the weft; and fifth, the timing of the motion is controlled entirely by the movement of the crank shaft. In drop-box looms the shuttleboxes rise and fall with the shed. When possible, always use plenty of harnesses in order to give free access in the heddles and prevent the chafing of the yarn. On fancy worsteds, kerosene oil sprayed lightly on the yarn will keep yarn from chafing and it will run much better.

Uneven weaving is not always due to the loom. A great many times the trouble can be traced to uneven yarn. By all means never use a conditional attachment for a take-up. The positive take-up is used to advantage in first-class mills, it being the only reliable one. A weave shop that is kept clean,

with shafting and hangers free from oil and grease, and with all looms kept in condition and all running with plenty of warps ahead, is to my mind a very attractive thing. In regard to weavers making waste, the only way to overcome this careless habit is to weigh each weaver's waste separately, and have a fine imposed upon them when too much is made.

## WORKING AT A PROFIT.

### ESSAY NO. 59.

In manufacturing cloth the object to keep in view above all others is: Can the product be sold in the open market to show a profit? In all our mills this is the one end aimed at, the one reason that hustlers are required. Our busy masters and superintendents have not time to throw away on useless work, and the lesson is enforced in a hundred different ways during the day that time is money. The minimum in expense and the maximum in production stand for success, and from the time the raw stock enters the mill until the finished cloth lies on the table of the buyer, problems are constantly cropping up, which require to be settled at the least possible cost in time and money, without detriment to the finished article.

In the opinion of the writer the most important place for the superintendent to keep closely in touch with is the weave room.

It is here that the threads are combined into cloth, and if the fabric sought is a nice looking, plain or simple twill weave, or one of erratic weave with loud, inharmonious color, the object is a commercial one, profitable, with repeat orders. In order to obtain this result, the manufacturer must keep in mind the fact that the cloth must be suitable for the millions and not for the few.

A design, both in weave and color, may be truly beautiful, but if after an initial expense running into hundreds of dollars in building the harness and purchase of costly materials, an order for a few suit lengths is the result, it can easily be seen that the speculation is not worth entertaining.

How is it possible to combine warp and filling of any material so that the goods can be sold at a profit and keep up a continuous sale? Away from every other consideration, this

is the question to be dealt with. Therefore practical examples are required of new and original effects, and competent operators to superintendent every process. The mere copying of patterns that are on the market is neither original nor of any value in a commercial sense to the manufacturer.

It may be necessary to dissect a sample cloth when orders are received to produce it, but if a firm stakes its reputation on imitations, it is beginning at the wrong end and advertising the fact that it is ignorant of its own business. A wise manufacturer always supplies neat, convincing patterns, that will last and remain popular through many seasons, and such a manufacturer knows full well that it would be entirely wrong to offer a pattern or design of any kind which is so costly to produce that loss ensues, and the word imbecility could alone measure such a blunder.

When the samples are on the market and orders are being received, the management must see that the production is kept up to the fullest extent capable of being produced. It can easily be seen that if the standing expense of a factory is, say, $400 per week, and capable production is 8,000 yards for the same time, that five cents per yard must be added to the cost on standing expenses account. Should the production drop down to 4,000 yards per week for a few months, the management will probably find on taking an inventory that the standing expenses have kept up to the high mark or pretty near it.

If there is one thing more necessary than another in connection with the weaving department, it is having good loom fixers. Such men may cost more for their skill, but in the end they will be found fully equal to their position in point of economy.

There will be fewer breakages all round, less waste and greater production, and that production will cause less trouble in claims, etc., through having the experienced workman at the head.

When we consider the improvements that have taken place in the loom it is not too much to expect the cloth to be free from a large proportion of the faults our forefathers had to contend with. Broken picks, thick and thin places, and irregular weaving should be firmly put down, when we have the positive take-up and let-off motion, the stop-motion, and last, but not least, the mechanism to stop the loom in case of an end down.

Perhaps it is not too much to say that no other textile machine has received and undergone so many beneficial improvements as the power loom, and when good work is demanded these improvements place in the hands of superintendents, overseers and intelligent weavers a power, the advantage of which cannot be overestimated. But with all the advantages and all our knowledge there is as much if not more in the application of it as in the possession, and in order that the weave room may produce to its best capacity, the looms must be kept in the best condition.

Driving power must be well kept up as the weavers soon become slack in that weave room where the engine is blowing up several times a day. Whatever the fault is, it should be attended to. The writer knows by experience of a firm where the engine was constantly losing speed; firm measures were not taken with the man in charge, until one day he resigned his position. A new man was put in his place. The engine went steadily after having been overhauled, with the result that the weave room began to get 50 to 70 pieces per week more of 50 yards each from 120 looms. It pays to give the best of power to the weave rooms.

The work of a loom fixer is peculiar, and not so easily described. Any carelessness on his part not only causes a scowl from the weaver, but the loom will certainly repay any negligence with a rebuff. Whatever is done should be done well, so that it will last for a proper length of time.

One of the main causes of the stoppage of a loom is the pick. The best constructed loom will be injured by an ill-regulated pick. The less force used in this motion, the longer will the loom remain in good condition. There is a certain portion of the crank's evolution which is utilized for the passage of the shuttle; the less of this time used, the more severe is the force exerted, while the more of it employed, the less the force and waste, and the greater the satisfaction in the work. A good fixer will see to it that the pick is especially easy on the stick farthest away from the cop nose, as any undue power on this side has a tendency to smash the cop, especially in weaving soft filling.

Many a fixer would be surprised if he would take the trouble to fasten a piece of cord to the top end of the picking stick and pass it across the loom, then over a projection, allowing the cord on which weights are fastened to hang toward the floor, until the shuttle is drawn from the shuttle box. The writer

has seen as much as 26 pounds hung on a loom that was supposed to be running in good condition. An enormous amount of power can easily be wasted in a weaving shed through inexperience and negligence.

The appearance, if not the construction of a cloth, may be injured in many ways by the loom, for instance, in the shed. Some fixers seem perfectly satisfied if the shuttle crawls through, yet this is of primary importance, that is, the evenness of the shed in preventing returns claims and seconds.

If four or five harnesses or any number of shafts are at all heights, it is impossible to make a smooth surface or face on the fabric, the filling will curl, the warp runs the risk of being broken, and a useless waste of time and material takes place. To make the loom as nearly perfect as possible will always pay in the production of more and better cloth.

The writer well remembers an instance where a firm placed a cloth on the market, in the weaving of which, on account of the peculiarity of the design—a large number of threads in the warp and medium twisted fine filling—a large number of curls appeared on the face of the cloth from the filling. The cloth had a clear face finish and the above defects were slightly visible when the fabric was finished. Buyers were anxious and willing to place orders, but were afraid to do so, beyond small lots, fearing that the cloth would be a trouble maker with claims, etc.

Experts were brought to see the looms. The sheds seemed to all appearances as perfect as possible, the shuttle eyes were filled with wadding to hold the filling tight, the pick was even and light, there was no rebounding of the shuttle, yet the curls were still there.

The writer was asked his advice, and taking a piece of cord passed it over the back rest, through the harness and reed and over the front rest, hanging a small weight at each end. It was found that the shed was not equally divided by the cord. The back rest was raised to bring the cord exactly in the centre of the shed. The wadding was then taken from the shuttle eyes, allowing the filling to work more freely; the loom started and the curls disappeared. Orders for the perfect cloth poured in, and in a few months the firm found it necessary to put in more machinery to cope with the increased trade.

Some may say this is a small thing, but the writer would impress it upon them that it is the small things in the weave

room that escape notice, until they have a way of making themselves seen in the loss of trade and profit.

## WOOLEN FINISHING.

### ESSAY NO. 60.

Practical woolen mill superintendents and up-to-date commission houses, in order to compete with other mills and houses of the like faith and order, are to-day looking forward to the finisher for the success of a great many different fabrics. He is expected to correct in the finish some very serious errors made in other departments of the mill. Cheap stock, dyestuff, etc., are considered in some cases by practical men, and quite often, to their sorrow, bring disastrous results when dabbled with to too great an extent. It is indeed in this channel in which float a great many of the finisher's most serious troubles. For instance, samples are gotten out for a certain fabric in which fair stock is used.

The same stock is used in making the first few pieces, but by-and-by, and little by little, the good drops out and that of an inferior grade is used in place of the good. As the cloth comes around to the finisher, at first it is not noticed much, as the changes have as yet been light. Just a little longer and the finisher is compelled to notice, whether he wants to or not, that the cloth is not felting just right in the fulling process. It takes longer to full, looks more hairy, and is away off in shade. By-and-by, down comes the superintendent. He has just had a letter from the commission house. They say: "The goods are away off in the finish. What on earth is wrong? Is this last lot of soap as good as the previous lot? Possibly the goods get too hot in the fulling mills. Something is seriously wrong, sir."

"Yes," says the finisher, "of late I've noticed the finish is not coming up to the original pieces, but having made no change in any part of the finishing process, I had naturally concluded the stock used was not so good as the sample (or original) pieces." "Yes, there is some variation in the stock, very slight. However, we have quite a lot of that stock in process, and cloth on hand already woven. I will expect you to match the original." So the finisher is at fault.

The writer had an experience some time ago which he is not likely to forget soon. During a slack season the mill management decided to try a cheap line of skirt goods which the commission man said was greatly in demand. We made up a line of selling ends, solid colors, blues, blacks, browns, greens, grays, etc.

The finest very much resembled a fine thibet, finished 55 inches; weight, 12 1-2 ounces. The samples looked "tip top." By-and-by, orders were rolling in beyond expectations. The first pieces came right up to the standard, excellent. It was too good to last. One day my attention was called to the fulling mills, and behold, there was a set of the blue which had reached a point to about 60 inches, and was defying the mill rollers, trap, soap, fuller, and all. What was to be done, was the question. It was simply flocking out, changing color and going to the bad as fast as possible. I had the superintendent come and look at it. His face commenced to grow long immediately. I had the cloth turned end for end, and doubled in the mill. Some of the weight was removed from the traps, and run for some time longer, but it was no use. It hung to that 60 inches, and would do no better. It was then taken from the mill, scoured, extracted thoroughly and again put in the fulling mill. It would not depart from that 60 inches, would take no more felt, and not even return to the proper color. Well, the superintendent came around again. He didn't know what on earth he would do if I couldn't finish those goods.

A shoddy house had put him in the hole. He didn't get what he had bought, etc. "If you can get out what cloth is on hand, I'll stop the carding of that stock at once." Of course I agreed to do my very best; the cloth was then taken from the burling room for another set. It is as well to say for an experiment I had this set thoroughly scoured and extracted. It was then doubled and put in the fulling mill, the mill springs were tightened a little in order to get more pressure on the start. A heavy neutral soap had been made for the occasion, on purpose. The mill was then started, the cool neutral soap gradually turned in, the cloth was not allowed to get above or below the proper heat, and to my surprise it fulled right up to the required width, and when finished looked as well as the original or sample pieces. The superintendent patted me on the back, I shook hands with myself and felt happy all over, just because I had met with

an accident that looked good to me. Anyone can see that the stock can cause lots of different kinds of trouble, and require many different processes in the finishing. Consequently it is well to look after the different grades of stock, wool, waste, shoddy and cotton. I think in the above illustration the shoddy used in the mix had met with a very severe carbonizing process, and required just such treatment as it received to neutralize it, and when properly neutralized, the fulling qualities were not materially hurt.

The writer is at present finishing a line of cheap velour. This is an easy fabric to finish if properly constructed, but we have our little troubles constantly arising, as each department makes some little mistake which must be fixed up in the finish. We will take, for instance, one style (22 line 2), composed of white warp, gray and black filling, woven 73 inches wide. I have been requested to be very particular in regard to the finished weight, which must be just 18 ounces. Just the least too much fulling on this particular style will cause a dingy, uneven face, no matter how it is sheared. It comes from the looms ranging in weight from 21 to 24 ounces per yard. Just think of it! Well, all the pieces must look, feel and weigh just the same, finished. The carder can make one lot of filling a little heavier than the last lot, so it may run well. The spinner is of course allowed the same privilege. There are positive take-up motions on the looms. However, the weaver pulls his wheel to help along a little. Finisher, poor finisher, it is for you to make up all this difference in weight. You must not change or let the face of the goods vary. Now two pieces of this style, 22-2, fall in line and march into the finishing room together. One piece will weigh 21.2 ounces, the other one 24.5 ounces per yard. They must weigh the same, look the same and feel the same, finished. Well, if I finish both pieces to 56 inches wide and make them both weigh 18 ounces per yard, full it up to just alike, then I am a Jonah. What must I do? I must take the heaviest piece, 24.5 ounces per yard, full it up to make 55 inches wide and stove it enough to weigh 18 ounces per yard, finished. The lighter piece, 21.2 ounces per yard, I must full up to make about 56 1-2 inches wide and stove it considerably harder to make 18 ounces per yard, finished. I will then have the same weight, appearance and feel. My only difference is, the lighter piece from the loom is 1 1-2 inches wider than the heavier piece. To successfully finish cloth as above illus-

trated, I must prepare a list for the fuller, explaining how much to stove the various weights and how wide to leave each piece in accordance, which is easily done by a little headwork. It is my belief that if more finishers would follow up this rule as above stated, lots of hard and uneven shearing could be overcome as well, as gigging or napping, which are a complete nuisance on cheap velours, not face finished.

Sometimes finishers are put to considerable trouble on hard-faced cassimeres, double and twists, especially where there is a cotton and cheap shoddy mix used, with white mercerized cotton for striping and overplaid. After the finishing process this white striping and plaid have been terribly stained, and oh, how it kills the pattern effect. For this trouble try fulling with cold neutral soap, and leave the mills open to prevent the goods heating. If this process fails to stop the trouble, a process must be gone into which will fasten the coloring in the black cotton, and clean from the fabric all acid left in the carbonizing process which the cheap shoddy used had possibly met with. I have overcome the trouble by scouring hard before fulling, and before removing the goods from the washer while the cold water is yet on, close the gates fill the washer two-thirds full of water, put in about five pounds of common salt to each piece, run ten minutes, open the gates, allow to drain, remove from washer, extract and full with heavy neutral soap, keeping the cloth cool by all means in the fulling. Mill wrinkles are sometimes very troublesome. Anyone troubled along that line will do well if he will turn the pieces end for end in the fulling mill when the cloth is about two-thirds up.

## TROPICAL WEIGHT WOOLENS.

### ESSAY NO. 61.

In view of the fact that nearly every season we hear more or less talk about a lack of originality and of a scarcity of new ideas and combinations in designs and fabrics, the above subject presents some ideas that I think are new or from which new ideas can be secured. It seems at present to be almost impossible to produce a very light-weight woolen at a reasonable cost, and the trouble appears to lie in the fact that the

yarns cannot be spun fine enough to allow sufficient texture being put into the fabric to make it firm enough to retain the shape when made into the garment. A few general propositions along these lines might not be amiss, and while they are only propositions, they are practical and successful up to a certain point. It is a well-known fact that 8 to 10 ounce broadcloths are made successfully from wool yarns, and while this fabric does not represent a tropical weight worsted, the fact that a woolen yarn fabric can be made 8 to 10 ounces and produce a satisfactory dress goods fabric leaves open the question as to whether a similar process of manufacture would or would not produce a fancy men's wear fabric of similar weight, and whether a few changes in manufacturing are not possible which would produce a satisfactory 8 to 10 ounce men's wear fancy woolen.

In the manufacture of broadcloths the carbonizing process is extensively used, not only for the removal of vegetable matter, but also to reduce weight, certain percentages of cotton being carded into the wool yarns and afterward removed from the woven fabric. This gives weight, the cotton being run in for two reasons: First, to give strength to the weaving, and second, to get weight. There is always some danger of having tender goods by this method, but a little experience along these lines is all that is necessary to have your goods in as good condition as if they had never been near a carbonizing bath. The objections to this method in a fancy goods fabric as I see it are confined to one point, viz.: Can the cotton be carded and mixed evenly, so that when removed from the fabric you would have even yarn left? One thing is certain: Solid colored yarns would not show the same as twists or mixtures, and with care these can be produced and give satisfaction. As a general line of experiment on this order use a fine wool of good staple and a good cotton, and mix well.

When introducing the twist, allow for sufficient strength in the finished fabrics. As to the percentages of cotton to introduce, the grade and quality of wool and counts of yarn wanted would govern this. In the first attempt, I would lay the goods out to shrink nearly square; in finishing they could be carbonized either from the loom after scouring the grease out or put up part way. In fulling remove soap and grease, and then remove the cotton and go on with the finishing in the usual way. Either method would be governed by the stock used.

Taking the goods from the loom would simplify matters. This method is used on broadcloths extensively and successfully, and no reasons exist, as I see it, why the same process of manufacture or an improvement on it cannot be made to produce a satisfactory men's wear fabric to weigh 8 to 10 ounces, 6-4 width. This is an era in woolen manufacturing when originality and skill in manipulation of stock are supposed to count, and it is certain the man who is able to get the most out of his stock gets the best results for his mill.

## ON DRAWING.

### ESSAY NO. 62.

Drawing is the principal department and one on which much depends in the preparation of wool or hair for the making of good even yarns. It is very important to know where to look for the defects which will cause a bad and uneven yarn, and consequently a bad spin, for it is the unevenness which is the cause of more bad spinning than the grade of the wool or hair.

Tops should never be drawn from the centre and put direct into the gill box, for in so doing the wool or hair is drafted or drawn twice in the same way and is sure to come out from the front rollers uneven, and no number of operations or doublings can possibly remedy this.

In passing through the gill box care should be taken to see that the pins in the fallers enter the wool properly, and the wool or hair should not be allowed to ride on the top of the pins, for should it do so the back rollers are delivering too quickly. The pins are split and the fallers require to be re-pinned. Then if the ratches in the drawing and roving machines are too long or too short, or if the drafts are too long for the grade of stock, these will cause a bad and uneven thread.

There is also the drag on the bobbin, which is very often overlooked and not much thought about; but even if the wool or hair is properly drawn and properly drafted and the bobbins are allowed to drag too hard, the yarn will be uneven.

## WEAVING.

### ESSAY NO. 63.

The requirements for the production of perfect cloth are good sound yarn, the perfect assembling of the same into groups according to given instructions, good and up-to-date machines for that purpose, and brains, with enough diligence to exercise the same in the right direction. The two last mentioned are factors without which the results will be unsatisfactory at best. It is a fact, nevertheless, that many times the various processes are condemned, not because the whole blame should fall on them, but because succeeding process managers or workmen lack the knowledge, and are devoid of the true spirit, to attack a seemingly hopeless case with enthusiasm.

A good, capable boss weaver will tackle the poorest loom that was ever built. He will take yarn that has been abused from spindle to beam, and yet produce a perfect fabric. Let us remember, none are perfect. We, too, have our off days. It is much easier to find fault with others than with ourselves. The processes of weaving by machinery are of far less importance than the knowledge, will, and "bulldog tenacity to succeed" spirit that furnish the power.

What is needed most is to know how to get the most out of that given us to do with, and then to get it. Poorly spun yarn, oversteamed or understeamed yarn, badly spooled on account of warped spool barrels or heads, bent arbors, poor dressing and beaming, singly or grouped, may cause some annoyance, but are no barrier to one who knows how, and will.

In the hope that this, "the whole story in a nutshell," will prove sufficiently interesting to set the reader thinking, I am for perfect cloth.

## UNION PIECE DYEING.

### ESSAY NO. 64.

In order to get good results in piece dyeing it is absolutely necessary to have the goods well scoured and the soap thoroughly washed out previous to dyeing. If the goods are not thoroughly clean, it often causes trouble for the dyer, as the

pieces will dye unevenly. Hard water is not suitable for scouring and dyeing, for besides wasting a quantity of soap it forms a sticky, insoluble substance with the soap, which sticks to the goods and causes them to show up streaky after dyeing.

Generally speaking, surface waters are soft, and spring waters are hard; river water should be fairly soft, as it contains a large amount of surface water. The hardness is, however, variable, according to the weather. The impurities that most affect the dyer and scourer are: C-H2 (CO3)2, calcium bicarbonate; MgH2 (CO3)2, magnesium bicarbonate; FeH2 (CO3)2, iron bicarbonate; CaSO4, calcium sulphate; MgSO4, magnesium sulphate; C-C12, calcium chloride; MgC12, magnesium chloride; H2S, hydrogen sulphide, and peaty matter.

The most abundant are C-H2 (XO3)2, MgH2 (CO3)2, CaSO4 and MgSO4, the others being present only in small quantities.

Waters that contain bicarbonates are said to be temporarily hard; all the others, with the exception of sodium carbonate, causing what is known as permanent hardness. By the hardness of water we imply its soap-destroying properties, which is shown by the following equation:

CaH2 (CO3)2 (calcium bicarbonate, soluble in water) plus 2NaC18H33O2 (soap soluble in water) equals Ca(C18H33O)2 (lime soap, insoluble in water) plus Na2CO3 (sodium carbonate) plus CO2 plus H2P (water).

CaSO4, CaC12, MgSO4, and MgC12 act in the same way on the soap, causing an insoluble precipitate.

There are three kinds of soluble soaps used in scouring, viz.: Sodium, potassium and ammonium soaps. The carbonate and bicarbonate of sodium have no action on soaps, as they form an oleate of sodium with the soap.

Peaty matter gives an acid reaction, and acids act on soaps, forming an insoluble body. Hard water acts on mordants and a number of dyes in the same way.

Permanent hard waters act on the soap in the same way as the temporary hard waters, but they are not so injurious to the mordanting and dye bath. Temporary hard waters, as may be seen by the following equation:

C-H2(CO3)2 (calcium bicarbonate) plus Ca(OH)2 (lime water) equals 2CaCO3 (calcium carbonate) plus 2H2O (water).

But you must be careful not to add too much lime water. Sodium hydrate may be used if the water is intended for scouring purposes, but not otherwise.

To soften what is called permanent hard water you must use a soluble carbonate:

$CaSO_4$ (calcium sulphate) plus $Na_2CO_3$ (sodium carbonate) equals $Na_2SO_4$ (sodium sulphate) plus C-$CO_3$ (calcium carbonate).

Usually waters are mixed, temporary and permanent hardness. They are then softened by means of a soluble hydrate, sodium hydrate or a mixture of sodium hydrate and lime. The reaction is as follows:

$CaH_2(CO_3)_2$ plus 2NaOH equals $CaCO_3$ plus $Na_2CO_3$ plus $2H_2P$. Then the $Na_2CO_3$ reacts on the $CaSO_4$; thus $CaSO_4$ plus $Na_2CO_3$ equals $CaCO_3$ plus $Na_2SO_4$.

Where room is no object, many have three or four reservoirs, while those less fortunate have to make use of tanks. The reagent and the water are run into one of the tanks and the whole is then agitated. It is next run off into a settling tank. There are generally one mixing tank and at least two settling tanks, and when the water has been allowed to settle it runs off into a store tank ready for use.

The ordinary winch dye kettle is suitable for the dyeing of union piece goods, but it is quite surprising to see so many flat-bottomed dye kettles in use, as they are not suitable for union piece dyeing, where you require to have the dye liquors as short as possible; the pieces are dragging all the time.

They are best made sloping from the back of the kettle to the front, and instead of threading the pieces through loopholes at the front, it is an advantage to thread them through the guiding sticks and have a roller fixed about six inches above and pass the pieces over it, and they will keep it revolving. This will keep the pieces running much better than dragging them through loopholes. I have also used kettles without a feeding partition. This is a great disadvantage, as the steam rushes through the perforation placed over the steam pipe direct on the pieces, and causes them to dye unevenly, and again you have the trouble of removing the goods if you want to add more dyestuff.

The most popular method of union piece dyeing is the one dip with diamond colors, along with azo acid colors, that dye the wool in a neutral bath. For heavy shades it is best to keep standing baths, as the color does not completely exhaust. Therefore the baths should be kept as short as possible. They should not contain more than twenty-five times as much water as the goods weigh.

It is best to insure the dyestuff being thoroughly dissolved by first mixing it into a paste with cold water and then thoroughly stirring it in hot water. Then run it through a fine sieve into the dyebath, and add 30 per cent. crystallized Glauber's salt for the first bath and about 15 per cent. for the standing baths for heavy shades. Light shades can be dyed in more dilute baths with from 10 per cent. to 15 per cent. Glauber's salt.

Enter the goods at about 110 degrees F. for heavy shades, and not above 70 degrees F. for light shades. Raise gradually to the boil and continue boiling for half an hour, or until the wool is approaching the desired shade. Then shut off steam and run half an hour. Then sample the goods. If the wool is not dark enough add more of the wool dye and raise to the boil again. If the cotton is not up to shade, add more cotton dye and work without raising the temperature of the dyebath, as the wool has not so much affinity for the dyestuff at low temperatures.

If the wool takes up the dyestuff too freely, add a small quantity of soda or borax, and avoid too high a temperature. This will diminish the affinity of the wool and increase that of the cotton. If the goods have to be steamed and crabbed, they must be chromed off in a second bath. The second bath should be adjusted alongside the dyebath, charged with 3 per cent. bichromate of potassium and 1-8 per cent. sulphuric acid on the weight of the goods; raise the temperature to about 120 degrees F. and run the goods from the dyebath into the chrome liquor and work half an hour. Then let the chrome bath run off and run in fresh cold water to rinse the goods, and after this treatment they will stand steaming and crabbing.

Good effects can be got on goods made from cotton warp and woolen filling, or where the cotton or the wool is thrown up to form a figured design; you must carefully choose the acid dyes that do not stain the cotton in an acid bath, and the diamine colors that dye only the cotton in an alkaline bath.

First dye the wool in a bath charged with the required quantity of color along with 10 per cent. Glauber's salt and 3 per cent. sulphuric acid; enter the well wet out goods; raise to the boil, and continue boiling for one hour. The goods are then well washed with water containing a little ammonia, to free them from the acid. The cotton is then dyed in a cold bath with suitable diamine colors, along with 20 per cent.

Glauber's salt and 2 per cent. soda. The cotton bath should be used over again if possible, as there is about half the color left in the bath, and you must use less Glauber's salt and soda for the standing baths. Very good effects can be got in this way, but you can get still brighter shades by topping them in a fresh bath with a little basic color.

The colors can also be made brighter by washing them in water containing a little acid and then washing them in clean water.

The following are examples:

Black and Red—Dye the wool with 3 per cent. napthalamine black; dye the cotton with 4 per cent. diamine red 4B; napthalamine black is sold commercially as alizarine black.

Green and Orange—Dye the wool with 2 per cent. fast acid green; dye the cotton with 4 per cent. diamine orange G.

Red and Blue—Dye the wool with 2 per cent. croceine A Z; dye the cotton with 4 per cent. diamine sky blue.

# A FEW POINTS ABOUT CARDS.

### ESSAY NO. 65.

In this paper I will take up some of the simple points about the cards. When putting the lap on, the greatest care should be taken to prevent the card from choking up and the lap should be handled with care. We might think anyone knows enough to run a card, but this is not the case. In some mills there are often men or boys who are extremely careless. The cards should be kept clean, sharp and well oiled; for ordinary work every four weeks is often enough to grind a card. Grind your card not too heavy or too light. Let it run about three days. Do not grind as much on the doffer as you do on the cylinder. The reason for this is that the doffer is so much smaller that it does not have to grind over as large a space as when grinding the cylinder. Have all the wires straightened up before the grinders are put on. In grinding the flats the greatest care should be taken to see that they are ground alike all the way across. When the flat comes in contact with the grinder see that it touches lightly and evenly and not too hard on the edge. As they leave the grinder roll the flats should

be tight and not allowed to get slack. See that the bands that drive the grinder rolls are tight so the grinder will have the same speed at all times. Have a burnishing brush to clean the flats, it will keep out all nips and motes. It is necessary to have the flats in good condition to get clean work. When stripping out I would recommend three times a day. The card clothing should be kept free from the fibres, motes and nips that will accumulate in the teeth of the cards. The stripping brush should not be allowed to go below the knee of the teeth on cylinder or doffer; if it does it is liable to loosen the card clothing. Striping out should be looked after very closely. To be convinced of this, before you strip out look at the sliver. You will see little nips. Then look at it after you have stripped out and see how clear it is. I would recommend when stripping out not to stop a whole section at once. Stop one of the cards, strip it out, and when the brush is being cleaned have the helper start it up and stop the second one. When stripping is removed he will be ready to put the brush on again. It is a well-known fact that after a card is stripped out the sliver will be lighter, so in stripping out this way you will not get all the light work at one time, and you will not lose production.

The card grinder must be a careful man and not have too much other work to do. In setting a card I would recommend doffer from cylinder, 7-1000ths gauge; flats from cylinder, 9-1000ths; from back, 12-1000ths; licker-in from cylinder, 7-1000ths; feed plate from licker-in, 12-1000ths to 16-1000ths; licker knife from licker-in, 10-1000ths to 19-1000ths; cylinder screen from cylinder, 22-1000ths; back knife plate lower edge from cylinder, 16-1000ths; front knife plate lower edge from cylinder, 12-1000ths to 16-1000ths. When setting the front plate the closer you set it the less stripping you will get out and the farther away you set it the more you will get. I think if you will follow some of these little things you will have a uniform web free from impurities. Take some of the web and hold it up before the window and you will find it free from nips and you can say you have good carding. You can have this by good grinding and setting. I would not recommend running a card too fast. About all revolving flats run cylinder 165, and doffers from 12 to 18 times per minute. The best way to get the speed of the doffer as it runs very slowly is to count the number of spokes of the doffer gear that pass a certain point in a minute and divide this by the number of

spokes contained in the gear. Suppose 14 spokes pass a given point in the gear in one minute and there are five spokes in the gear; then 74 divided by 5 equals 14.80 revolutions per minute for doffer. If you follow these methods I don't think you will have to make any excuses to the manager about bad cotton or that the machines are left in bad shape. If you have not been at the place very long, you will still be able to form a fair estimate of the ability of some of the new ones who take hold of the business by the amount of talk they put in when nothing is right and about everything has been run wrong. You can estimate him as a bag of gas, and the superintendent who takes stock in such a man is certain to be disappointed—give us the man who will adapt himself to circumstances and, taking off his coat, go to work and let the results do the talking.

## POINTS ON KNITTING.

### ESSAY NO. 66.

The knitting of hosiery is a very interesting work, that is, when you take into consideration the way the stocking is made. A person that is not acquainted with the craft would stand in wonder looking at the machine and cone of yarn, and to see by putting the yarn into the needles of the machine in a short space of time a stocking produced and ready for the looper and welter, then to be dyed and finished.

There are many little things that a practical knitter must know in order to produce a perfect stocking. It is not all in the machine nor is it in the person who operates the machine. These two factors are a great help in producing a perfect stocking, but the most important factor is the adjustment of the various parts of the machine operated. First of all, the cams that raise the needles up and down should be ground in such a way that when the cams of the machine revolve around the cylinder the butts of the needles in the cylinder rest squarely on the cams, thus preventing breakage of needles. This also relieves the needles of 50 per cent. of their labor.

This does not always remedy the breaking of needles while the machine is revolving, but in most cases it does. It will

also help if some slots, in which the needles work, allow the needles loose play. Furthermore, in producing a good stocking the needles must be in good order. They must be kept straight.

Each needle must have enough tension so the needle will not move anywhere outside of where the cams or the pickers of the machine move them. The latch must be kept straight, so that when the needle is making the stitch the cup of the latch presses squarely against the head of the needle. The rivets, on which the latch swings, must be perfectly smooth on both sides, so that when the needle is going down through the stitch the loose or rough rivets will not tear the stitch. I would like to say just now there is no way to fix loose rivets except by taking the needle with the loose rivets out and replacing it with a new needle. Furthermore, the sinkers that hold the stocking down while it is being made must hold the stocking down at the right time and place.

The sinkers should be adjusted in such a way that when the needles are descending to make the stitch the sinkers must be out of the way, and the sinkers should be pushed in before the needles ascend, so the sinkers will push the previous stitch back and hold down the new stitch the needles have just made.

Now, this is a very important matter in the knitting of hosiery, and should be strictly adhered to. These few points that I have tried to make plain are the most important things, taking it for granted that the machine is in good working order.

## WOOLEN SPINNING.

### ESSAY NO. 67.

In the spinning of woolen yarns there are a great many things to be taken into consideration in order to obtain the best results.

I will first take the mule, which must be kept well cleaned and oiled. The roller beam and rollers should be kept on a perfect line, and also the spindles and guiding and tension fallers. The cylinder should be set the same distance from the spindles, the whole length of the machine. This will give the bands an even tension.

In my estimation the bands are a very important part and cannot be watched too closely, especially the cotton bands, which are subject to the weather. If the bands are too tight they will cause the mule to run hard and on damp days it will not back off without an extra amount of spring to pull the back-off friction in. If springs are too tight and bands are the same, it will be the cause of many broken castings.

When the mule is in at the beam and the carriage is against the bunters, the tops of the spindles should be about one and one-half inches from and a little below the bottom roller.

The ropes on the mule for the different motions should be a certain size for each motion. If the ropes of each different motion are not all of the same size the largest rope will take up the fastest and the mule will not run as smoothly as it would if the ropes were all of the same size. The drawing-out rope should be tight enough so that the drawing-out check rope will not slack any when the mule is drawing out.

It is very important to have the mule build a good bobbin. To do this we will have to take the quadrant and builder motion into consideration. I will first take the quadrant. If it is set at the right pitch it will not allow the tension faller to run over four inches above the tops of the bobbins and will bring it down even with the tops of the bobbins, where it should be before the mule strikes in.

The builder should be watched to see if it feeds the same amount at every draw. The studs and shoes on the builder rail should be looked after to see that no parts of them are worn.

The back-off chain should be adjusted so that it will not allow too much slack yarn when the mule backs off. On Davis & Furber mules and on some others there are stands on the faller rods with adjustable shoes on the floor to protect the yarn when the strain goes on it from the tension faller. These shoes should be adjusted so that it will take the slack out of the yarn and at the same time not allow the strain to go on the yarn with a jerk, causing the yarn to break or be strained and make twitty places.

After the mule backs off, the tension faller should be at an even distance above the tops of the bobbins the whole length of the mule.

The tracks on the floor should all be on a level, and the spindles all of the same pitch and with the proper amount of weights on the tension faller.

The delivery of the roping from the spools to the spindles should be properly cared for. The roping should be delivered so that it will be of an even tension the whole length of the draft. The drums on which the roping rests should be speeded to compare with the rollers, for if they are not speeded fast enough it will make twitty places in the roping, therefore making twitty places in the yarn. The roping pin gear should be looked after to see that the cogs are not worn, for sometimes when they are worn badly, they will slip a cog or two, letting out more roping than is desired and making heavy places in the yarn unknown to the overseer.

The drawing of the mule is one of the most important parts to be looked after in the making of good yarn, for in good yarn you must have strength, elasticity and an even thread, and in order to get it the carriage must be properly speeded with the rollers, or the rollers properly speeded to suit the carriage. See that the proper wings are on the draft scroll for the kind of stock you are making and the length of draft you have on the mule. If the mule is drawing too fast it will make an uneven thread, full of lumps and twitty places. The drawing-out rope should be kept tight enough so that the drawing-out check rope will not be the least bit slack during the outward movement of the mule. Under these conditions the mule will travel in a steady manner and a good smooth thread will be the result.

The twist in the yarn is very important in making good yarn. You want just the right amount. Too much will make the yarn brittle and will not stretch as it should. Not enough twist injures the strength. The twist pin gear, like the roping pin gear, should be watched. If the cogs are worn, it will slip a cog or two and cause an uneven twist in the yarn. In making splices in ropes care should be taken to have the splice the same size as the rest of the rope and have each strand pull even. The same idea may be applied to knots in ropes. If the strands do not pull with an even tension, the tighter will break first, causing the rope to go to pieces in a shorter length of time than it would if all pulled evenly.

The rim band should be at just the right tension. If it is too tight, the mule will run hard. If it is slack, it will slip on the pulleys as the mule starts from the rollers and the yarn will be losing some of the twist. Sometimes it is the cause of spindle points (a turn or two of roping partly twisted on top of the spindle), which sometimes break as the mule backs off,

and at other times are wound on the bobbin and make trouble in some other room. A little paraffine wax rubbed on the ropes where they chafe will make the ropes last longer.

# KNITTING FANCY SHETLAND SHAWLS ON THE DOUBLE RIB KNITTING MACHINE.

### ESSAY NO. 68.

This machine is complete with six guide bars and two needle bars, and uses latch needles, and is from 50 to 100 inches wide. The guide bars are individual, and by using all the bars you can get some beautiful patterns, or you may use as many as desired. By making one go up and the other go down, or float, you get your different patterns, and this is done by chain. At the right end of the machine is the cylinder on which you place the chain. The chain is in different sized links, from 1-2 inch up to 2 1-2 inches high, and you can covér 12 needles, if desired, at one time, or less, just as you may wish to make a pattern. There is no limit to the length of the chain. You can have it either long or short, or one long and the other short. After building the chain, put it on the cylinder and set it as you want it to work; then turn the machine over a few times to see that it is all right. Then you are ready to draw in the warps. Draw the main warp in first and get it on the needles; then draw in the other warps as it is most convenient; then it is ready to work. The needle bars work up and down; when the back is up, the front is down. The shawls are made in strips wide enough for the shawl and are cut to the right length, and a fringe border sewed on by machine, and when it is finished it is a beautiful Shetland shawl. This machine can be used for almost any kind of knitting with very little changing, such as golf vesting, bear cloth, eider down, underwear and blouses. You can always find something to do on these machines.

# KNITTING RIBBED UNDERWEAR.

## ESSAY NO. 69.

The important items for the production of perfect goods are (1) Stock of the yarn. (2) Evenness in spinning, (3) Winding, (4) Tying of Knots, (5) Perfect adjustment of machine, (6) Speed of machine, (7) Proper size of hook on needles, (8) Condition of needles, (9) Tension on cloth from take-up, (10) Lubricating, (11) Character of yarn, considering the twist, (12) Proper number of courses, considering gauge and number of yarn, (13) Cleanliness of machine, carefulness of knitter.

I will not linger on how the machine should be adjusted, for any practical knitter knows that; there are other things that are important in making perfect goods or as nearly perfect as possible. The most important is the yarn, of course. Now we are running, say, on 1-24s or 1-26s bleached cotton on 10 and 12 cut machines. I have often put up a set of bobbins on a perfectly adjusted machine, got my length and fell right and had the machines run along nicely for a good while. The knitter comes for me to look at the machine; it is cutting holes, and the cloth looks different from when I started it. I go to the machine and find the cloth wide and harsh, the length shorter and the goods imperfect, cutting holes. We first look over the machine to see if it is out of adjustment. It is all right, the same as I left it. What am I to do? The machine an hour ago started up well, making perfect cloth. The adjustment has not been tampered with. Then it must be the yarns. The first thing I do is to look over the yarn to see if any bunches or knots are caught in any part, thus causing a strain. Everything there seems clear. The next step I take is to use the best tool in the mill, the oil can, filled with coal and lard oil; use sparingly. I give the needles a little oil, especially where the latch works. By doing this it works out the foreign matters which get in the slot of the needles, such as lime, chemicals, or fibre. Let it stand several minutes. This will give the coal oil time to loosen the foreign matter from the needles before starting up the machine. Ninety times out of a hundred that is the cause; if not, take off the set of bobbins and replace with another set, using the old set by adding one or two occasionally.

Now I will go on yarns in the gray, of, say, the same number and on the same machines. Now we have a hard twist yarn to run. I find that steaming the yarn a little, just before

going to the knitting machine, overcomes most of the difficulty that is possible on hard twist yarns, and still it does not impair the feel of the cloth after knit and set. Or if no arrangement can be made for a little steam, keep your yarn in a damp basement, and leave there until ready for use. By no means let your yarn dry out before knitting up, for if it dries on the cone or bobbin the fibre of the cotton will stick, and you know the results. By this process you will produce better results in knitting and still you will have the lisle fell to the cloth.

Now as to the general run of the knitting room. First of all keep your room and machines clean; demand and have good winding; if the stock in yarn is inferior or the spinning bad, report same to your superior. Then he will know that you cannot produce perfect work with inferior stock. Be stern with your knitters; caution them about bad needles; give them freely a good needle for every bad one taken out, for it is cheaper to buy needles than to make bad work. Let them know the value of the goods they are knitting, what it amounts to in a day's run; show them the waste that can be made by using too much oil, and explain to them the advantage of a little oil often, and the disadvantage of pouring it on. Soon they will know exactly what you require and the best way to produce perfect knitting. These few facts I find to be quite important in a knitting room.

# COTTON WARP PIECE DYEING.

### ESSAY NO. 70.

In the dyeing of cotton warp piece dyes there are several processes that we can use. Now seeing that the goods are generally of the cheapest construction, very little if any wool is used in the goods, merely, a cotton warp with a shoddy and cotton filling being used. The main point in the dyeing of the goods is the covering up of all imperfections, such as burrs, shives, specks, etc., which the goods naturally contain to a large extent. Now there is the old-fashioned sumac and iron process, which is the best on certain classes of goods even at the present time.

The wool or shoddy part of the goods is generally of a dark nature, therefore we have to use the very brightest of aniline

colors to get the results wanted. The pieces are first dyed, that is, the shoddy part of the goods, in a sour bath with the aniline colors to the shade wanted, an allowance being made for the after process, or the sumac and iron, which will darken the shade to some extent. They are then well washed to remove all traces of acid as far as possible. It is best to run them in a washer from thirty to forty-five minutes, as better results can be got that way than in the dye kettle. They are then ready for the sumac kettle, which is generally kept as a standing bath. The amount of sumac to use depends largely on the depth of shade wanted and on whether the extract or the ground sumac is used. They are run in the sumac kettle from three to six hours. Take out and run in the nitrate of iron kettle for one hour. The amount of sumac and iron to use depends on the depth of shade wanted on the warp. In most cases a black warp is wanted. Now when blacks are wanted they can be prepared and dyed a logwood or hematine black and then run through the sumac and iron with good results, or the warp and filling dyed with a union black in one bath, which is a great saving of time, but costs a little more. For a good, bright light blue use alkali blue 2 B, sulphate of zinc and sal soda. Develop in two baths at 160 degrees with oil of vitriol and sweet magenta; wash well and sumac and iron. For medium and dark browns prepare and dye with fustic extract, logwood extract and alizarine red powder; for medium blues formyl violet S 4 B, formyl violet 6 B, indigo blue N, acid magenta; for dark blues, indigo blue N, fast acid blue, acid magenta and orange R; for wine, indigo blue N, acid magenta, orange A; for light and dark greens, indigo blue N, fast yellow O.

The union dyes are very good where warp and filling are wanted the same shade, covering up the imperfections in good shape, but not giving as heavy a warp as the sumac and iron process. The only objection to the sumac and iron process is the length of time it takes to put them through. A good one-dip process can be got by using the neutral dyes for the shoddy part of the goods and dyeing the warp with a tetrazo diamine black or direct black in the same bath.

A good black can be got this way by preparing and dyeing an ordinary logwood or hematine black. Boil wool or shoddy part to shade and put in kettle from 15 to 20 per cent. of common salt; boil about five minutes to dissolve salt, shut off steam and feed into kettle the necessary amount of cotton

black well dissolved, and run from one to one and one-half hours with the steam shut off. Medium and dark browns can be dyed the same way by first preparing and dyeing to shade with extract of logwood, extract of fustic, alizarine red powder, and dyeing warp the same way as for blacks.

Very often what is known as a cadet gray is wanted on these goods. This can be dyed one dip in a cold liquor by using 1 1-2 to 2 per cent. of a good cotton black with 20 per cent. of Glauber's salt. Run goods in this for about two hours or to shade wanted. Medium and dark blues can be got by using fulling violet and wool blue, only in this case the salt goes in with the dyestuff and the treatment is the same on the warp. In fact, a large variety of colors can be got this way by using the neutral colors for the filling and dyeing warp up with cotton black. Of course none of the acid dyes can be used this way, as no trace of acid must be in the goods or kettle when dyed by this process.

# OPERATIONS PERTAINING TO KNITTING.

### ESSAY NO. 71.

In running a knitting mill on ribbed underwear, with the present prices of yarn material, etc., in comparison with the prices received for the finished product, the strictest economy in production must be practiced until it would seem that the end had been reached in this line.

The yarn should be reeled and weighed from every case as it is opened up, every case should be weighed before opening, and the case and other tare weighed when empty. It will be found that the cones, paper, etc., will at times go over the allowance made by the yarn mill.

The reeling and weighing of the yarn give the knitter an idea how to set the machines in order to get as even weighing goods as possible.

In making shaped goods too much care cannot be taken in measuring to see how the lengths are running. When a quarter is off, it is the practice of some knitters to raise the dial in order to make it easier for the operator to put the

cloth on the needles. This is poor practice, as it makes a hand more careless, for he does not put the cloth on the needles as neatly as he would if the dial had not been changed.

When the dial is raised in this way the machine is many times started up without readjusting and sometimes a number of garments knit before it is changed back again.

The yarn when bought is bought on cops or cones and rewound on bobbins. When it is bought on cones it is sometimes knit directly from the cones. This helps out where labor is scarce, and it also saves floor space by not having so many winders. When yarn is knit from the cones it is best to leave a little piece of yarn on and have this wound on the bobbin. Some knitters object to knitting from the cone, but it is better to knit from a good cone than a poorly wound bobbin.

In taking the rolls out of the machines both ends of the roll should be marked or stamped with the size of garment, number of yarn it is made of, when difficult grades and weights are made, also the number of the knitter. This marking is best done by using a set of stamps and quick drying stamping ink. When taking the rolls from the machines it should be someone's business besides the one who tends the machines to look the rolls over carefully and see that there is no bad needle left running, to make streaks, cause dropped stitches or make holes. This puts a check on the knitter and will save much poor knitting. The rolls, being ready, go either to the dyehouse or the napping room as the case may be.

In order to have a good nap at all times the worker rolls should be recovered, three or four rolls at a time as the nap would require, this way of recovering only three or four rolls at a time keeping the nap more even at all times. The practice of waiting till the nap is all down and then recovering all the rolls at one time gives a very poor nap just before covering and a very good nap after covering, making two extremes. In covering three or four rolls at a time the rolls can be numbered, and the rolls covered in rotation as the nap calls for it. When this way of covering the rolls is adopted, the very poor nap before covering and the very fine nap after is obviated, giving a good even nap all the time.

After napping, in order to get the right width of roll wanted, a measuring stick should be used, showing size and width of roll, this stick to be put on as the roll is spreading. When

the roll is spread if found to be out size, it should be respread right then and there.

A similar stick should be had in the cutting room and the roll measured before cutting. If it is found not to measure up the right size it should be sent back to the napping room to be respread. If this were insisted on, it would materially help to keep the goods up to the proper size; it also would save waste by not having the rolls wider than required. The cutting room is fully as important as any other department in the mill.

Cutting is done with shears or knife by hand, with power knives of different descriptions. Cutting by the piece should be avoided; cutting by the day is to be preferred. More seconds could be saved by greater care being taken in turning out holes, etc. Waste also can be saved as well as seconds avoided.

In cutting straight cloth a cutter will cut a piece off rather than turn a hole out. Every time a piece is cut off more waste is made. When it has to be cut off it should be cut long enough for a sleeve.

By having the cutting done by the day, more care can be taken in turning out holes, and in cutting straight cloth a great deal of waste can be saved. A small amount of waste would make a day's pay for a cutter, and the wages paid, or the difference paid between piece or day work, is not to be compared with the extra amount of waste made and the number of seconds allowed to go through which might have been avoided.

A record book should be kept in the cutting room and a few dozen of each style and size weighed every day and recorded in this book. From this book it can be ascertained at any time how the goods are running; a report to be made every day of the number of dozen cut of each style and the waste made.

The waste before taken out to be baled up should be gone through thoroughly to see that no pieces large enough for sleeves and gussets when needed slip through. By following this up a great deal of waste will be saved.

Poorly knit rolls should be reported as they come to the cutting table in order to keep a check on poor knitting.

The cutting room should have a system of cutting the goods in order lots, each lot to be completed before sending into the finishing room. The number of dozens should be counted

and order checked when it goes into the finishing room. After an order has been checked and brought into the finishing room, each lot of goods should be kept going through together. This can only be done by having someone to give the work out to the hands on the different operations, whose duty it would be to see that all of a lot is completed at each operation and sent along to the next one. This would help out in the packing room.

In some mills the goods are sent from the cutting room without the sleeves, the tops only being seamed, the finishing up, buttonhole and button sewing being done before the sleeves are seamed in. When this is done, the sleeves for each order ought to be cut, checked and sent in with the goods as they go into the finishing room. Otherwise, too many sleeves of one kind may be cut or not enough of another.

There is one objection to sending work through in this way; that is, that when goods are seamed and covered, the garment being finished, and the sleeves seamed in afterward, it necessitates the garment being covered with the trimmings all on. In covering, the operator would have to run in on the edging or binding, which would make it look untidy, besides leaving threads to be trimmed which would be covered up by the finisher, if the garment had been all seamed up and covered before any trimmings had been put on.

Seconds should be saved to teach the learner, in the finishing room. In sending the seconds through, separate odds and ends in the trimming line can be used up in place of lying around and getting soiled or otherwise wasted.

Cleanliness should be insisted on. The kind of work done in a mill can almost be judged by the way things look around it. No oil cans should be allowed on the tables. Carelessness in oiling and otherwise being careless in handling the work causes a great many seconds which with more care could be avoided. Keeping nice and clean in a mill means better work, as it helps to keep things up all around and the help will like it better.

In taking on new hands great care should be taken to teach them properly. They should be looked after from time to time, so that they will get into the proper way of doing the work.

The overseer in charge of the finishing room does not have time to bother much with the learners if the mill be of any

size. There should be a woman to take charge of the learners as they are put on, whose business it should be to keep looking after them and help them out from time to time. When the learners are left by themselves too much they are apt to become discouraged and consequently more likely to leave, whereas, if there had been someone to come around to help them out now and then, showing an interest in their getting along, it would encourage them, consequently they would like it better and be more apt to stay. This would do away with having too many learners, and naturally would mean less poor work. Having a lot of learners in a mill certainly is a great drawback to the production and to the quality of the work.

The finishing machinery should be well looked after, and a fair supply of parts should be kept on hand. There is no economy in letting a machine run poorly for the sake of a part, neither is there economy in holding a machinist down so close on parts that he will patch any way at all and do anything in the world rather than order what he really needs.

Where this is done the machinist is not apt to stay any longer than it takes him to find something else, and the mill will be changing men all the time, each one thinking only of getting along somehow while he is looking out for something else.

A good sewing machine fixer is a good asset to any knitting mill. He will have his parts and supplies taken care of in such a way that he can put his hand on anything he wants, and not have to hunt longer than it would take to fix the machine.

When the goods are inspected they are ready for the press room, where the goods are pressed, folded and boxed ready to pack. Sometimes the goods are put through a mangle, but at its best this machine is a mangle and that is all. The hydraulic press, the goods first having been boarded, is the most satisfactory.

The folding and boxing are two very important operations. The folding should be done by the day. It is very easy to fold up and overlook some fault in the garment. This work cannot be any too well done. No more than a reasonable number of dozens folded should be expected from each folder. If the goods are folded carefully and put in the box nice and smooth, it gives a favorable impression in opening up, which would prove to be a great advantage to the manufacturer in more

ways than one. Finding boxed goods wrinkled and doubled up certainly gives the goods a poor recommendation.

In the press room there should be a system of keeping accounts. A report should be made each day of the number of dozens folded, the number of garments having to be mended, and the number of garments of imperfect work having to go back to the finishing room. The imperfect work should be kept track of, the garments going back to each operation being counted, thus giving the one in charge a chance to know where the imperfect work comes from.

The seconds should be kept track of, that is, every garment folded as a second should be recorded, whether a second on account of a mend, rundown, oil, dirt, or spoiled in the finishing up processes. This record at all times would determine the cause of the seconds, making it easier to keep them down.

There are a great many details to be looked after all the time and constant care and watchfulness are necessary in order to keep things running smoothly. There are many things which go to make a mill a success or a failure which we cannot touch on in this article.

## WORSTED YARN SPINNING.

### ESSAY NO. 72.

We have three kinds of spinning, viz., flyer, caps and ring, which all play an important part in making yarns. It would be as well to take the first mentioned as flyer spinning, though all the above methods have their advantages on various yarns.

Some spinners prefer the flyer system for the purpose of spinning knitting yarns in low numbers, this method giving the yarn a smooth appearance. It is also possible to obtain better results regarding the twist on these yarns. The spinner must be very careful to make a good selection of washers. The proper size should be considered, also the drag must be uniform. For instance, it would not be advisable to use the same washers to spin 1-5 as in making 1-16. We would be compelled to have a larger drag on the former than on the latter. Great care should be taken to have all spinning bands the proper tightness, and care should be taken to have all

roller belts free from oil or dirt, in order to avoid slipping. Slipping of these belts causes more twist to be put in the yarn than is required and in several cases makes yarn such as can be used for nothing but tie yarn or waste.

It is the duty of an overlooker to have proper weight on the back rollers, in order to prevent the yarn from being pulled through, as the result would be bad yarn. He would find it to his advantage to look over these rollers at least once a week, also to go over the front rollers about twice a week, and remove all blistered or cut rollers. Cut rollers are made in several ways, most of them coming from the guide being stopped back of the back rollers. A roving that is twisted too hard in the drawing will not be in the spinner's favor. Careful attention should be given to a roller that has been worn down to the wood or glue, and it should be removed immediately. It would be impossible to get the proper draft from rollers in such condition. All carriers should have proper speed, the same as fallers on a gill box. The bottom carrier should be running the fastest of all three; the middle one a trifle slower, and the third a trifle slower than the middle one. Ratches should be set at proper distances from the nip of the front rollers, and above all a suitable draft for counts and stock should be considered. All the above should have the overlooker's prompt attention, as they are most important in worsted spinning. We have several other minor complaints, but the most important has been mentioned.

## WORSTED COMBING.

### ESSAY NO. 73.

In the making of a worsted yarn the combing of the fibres is perhaps the most important process through which the sliver passes in its journey through the mill. Should the wool have been imperfectly carded, this can be remedied in the combing, though perhaps at the cost of an increase in the price of the top, owing to the larger proportion of noil to top; but no amount of careful drawing or spinning or any other subsequent process will ever remove the neps or lumps left in the sliver after combing. It is therefore very necessary

that the worsted spinner should pay very special attention to the combing of his tops, his aim being to produce a sliver containing parallel fibres of as nearly as possible equal length, free from neps, burrs or other vegetable matter, with as little noil as is compatible with these conditions. At the same time he has to remember that the clearer the noil is, the higher is its market value and its assistance in reducing the cost of the top. To enable the comber to accomplish this, the wool must have been carefully washed and carded, so that the sliver delivered from the card room is composed of fibres as straight and as free from neps as it is possible to prepare them. Having left the carding engine, the sliver generally undergoes three preparatory processes of treatment before being placed on the comb, viz., backwashing, gilling and balling.

Owing to the oil used in carding and the dust picked up as the wool passes through the engine, it is generally found necessary to subject the sliver to a process of backwashing to obtain a top of as good a color as possible. Passing it through two bowls of hot water, the first containing sufficient soap to cleanse the sliver, the second only enough to prevent the rollers from cutting the sliver, after leaving the second pair of squeezing rollers, is dried over five or more heated revolving cylinders, being drawn off on to a balling head gill box. Before entering the fallers, sufficient oil or mixture can be applied to ensure the condition of the sliver being right for the comb. On medium and fine qualities, very little oil is required, one gallon to a thousand pounds of sliver being generally found adequate for this purpose.

To open out and straighten the fibres preparatory to combing, the sliver, after leaving the backwasher, is passed through two gill boxes, a double head and single head balling box. The fallers of the boxes will vary according to the quality of sliver being treated. For fine botany wool, they should contain two rows of pins set 16 to the inch; for medium qualities, 14 to the inch, and for low strong wools, 10 or 11 per inch.

The sliver taken from the single head balling box is wound on a ball making machine in the form of a drum about eighteen inches in diameter, four ends being wound side by side in one ball. The weight of one ball is generally from fifteen to twenty-five pounds, wound tightly enough to form a firm drum, but not so tightly as to mat the ends together, and so prevent their freely running off when placed on the carriage of the comb.

Of the three well-known types of worsted combs, the Noble, the Holden and the Lister or nip, the Noble comb is practically the only one in general use to-day. The Lister or nip comb is only suitable for the very longest wools, and is in greater use in the mohair and camel hair trades. The Holden comb, though capable on some classes of botany wools of producing a top better in appearance than one combed from the same wool on a Noble comb, is only adapted for certain classes of fine wool, and has the further disadvantage that the proportion of noil to top made on this comb is greater than is the case on the Noble comb. There can be no question among worsted combers that for adaptability and cheapness of combing, the Noble comb stands alone. With changes of circles, one comb is capable of producing tops varying from 36s to 80s in quality. The production of a Noble comb varies considerably according to the class of wool being combed and the proportion of noil made. It turns off as much as 600 pounds a day on some low wools, with the large circle running at five revolutions a minute, but perhaps not more than 200 pounds per day on fine wools bearing six of top to one of noil, with the circle revolving three and a half times a minute. Though this comb in its principle of combing is comparatively simple, it is a machine of many details and of points which must be carefully watched to ensure a satisfactory delivery of top.

The heat of the steam chest must be well kept up, in order to obtain the best results, for the hotter the pins, the more easily will the wool be drawn through them and the better will be the appearance of the top. At the same time, care must be taken that the comb balls are not too dry, or there will be many laps around the drawing-off leathers, and consequently much waste. If the comb balls have been in stock some time, and the outsides have become dry, it is often necessary to sprinkle the ends with water as they are going through the trap boxes, in order to get the comb started.

A cause of bad work on many combs is the unevenness in the circles. Though the large and small circles are set to just touch one another at a certain point, if the comb be moved around, a space of 1-8 inch to 1-4 inch may perhaps be found between them at the point of contact, sufficient room to allow many large neps or knots to find their way into the sliver. This may be due to badly made circles or to circles which have been damaged by laps or other accidents, and have not been carefully straightened by the pin setter, or it may

be the result of unsteadiness in the circle rack. This latter is often the case where the rack is borne on runners of the old-fashioned type, which, if not carefully and frequently attended to, soon develop much play in their bearings, and so cause unsteadiness in the running of the comb. The steadiest rack to-day is that carried on ball bearings, the balls running in a semi-circular groove on a plate attached to the steam chest, another groove being on the under side of the circle rack. This gives an almost perfectly steady running rack with little friction. The balls should only touch the bottom of the groove and should not bind against the sides, and these grooves should be examined at least once every twelve months, to see that they have not worn down, causing the balls to bind and thus making more friction in the driving of the comb.

For medium and fine wools, large circles are used, with eleven rows of pins, the inner rows of pins being flat, and small circles with eight rows, the two outer rows of which are flat pins. Many combers would prefer circles having more flat rows, but while the dabbing brush is used to put the wool into the pins this is hardly practicable, as the flat pins tend to destroy the bristles of the brush much sooner than is the case with round pins. The circles should be picked as often as found necessary, and the pins carefully examined and straightened, if good results are to be obtained, as broken pins or gaps in the circle are a fruitful source of bad work in the tops.

The circle knives should also be frequently examined, and when necessary the points filed, for if the knives be allowed to wear to a very sharp point, any little irregularity in the brass of the circle will be likely to catch them, causing them to buckle up and probably do excessive damage to the pins in the circle.

When starting the comb, both sides should be tested, to find any difference in the amount of noil made, and the noil knives adjusted accordingly.

Although for many years much time and thought have been given to the invention of a contrivance to supersede the brushes, nothing has yet been brought out which can be considered altogether successful. Knives and circular discs of various kinds have been tried to place the wool in the circles, and though this has been accomplished it has been at the cost of many broken pins and ruined circles. Should however, a successful substitute be found for the brush, as some day

no doubt it will, much expense will be saved and many further changes and improvements might be made in the Noble comb.

However, during the past few years great improvements have been made in the dabbing motion itself, and to-day it is possible to run a dabber satisfactorily at 1,000 dabs per minute. Though this speed has been attained with a single slide dabber, the latest type, having two slides, one carrying the brush, the other set to move in the opposite direction carrying a balance weight, is found to be the most easy and steady running at a high speed. The speed of the comb itself must be governed by the speed of the dabber, for, should the circle travel too fast for the brush, the result would be that the pins would be dragged through the bristles of the brush before it was pulled out again, doing much damage to the brush and causing bad work to be turned out. If poor bristles are used in the brush, it will be found that after running for a short time, they will begin to bend and curl up, and instead of dabbing the wool down firmly into the circles, will be apt to pluck at it and so cause a roughness in the sliver. Brushes should be kept well repaired, and when wearing down can be made to last longer by lowering the slide of the dabber. With most classes of wool there is no trouble when the fringe reaches the drawing-off rollers, but should the wool to be combed be of a very bulky, lofty nature, it is sometimes advisable to fix a small knife in the inside chamber of the big circle on the top of the wool opposite the drawing-off rollers to prevent fibres being drawn over the top instead of through the pins.

Many types of cleaners are at present in use, but perhaps the most successful is the rotary circular brush which, being pressed against the pins by means of a spring, is revolved by the circle itself, and is found to effectually clean the pins of knots of wool, burrs or dirt.

Next to the cost of brushes on a Noble comb, the most expensive item is the leather used on the drawing-off rollers. Recently many improvements have been made in the drawing-off rollers to increase the life of the leathers. Many of the ideas at present on the market are equally effective, the essential feature being that the two drawing-off rollers should be fixed and should remain exactly parallel to one another, so that the pressure on the leather is equal in all its width. It is generally found cheaper to use the best leather for the drawing-off rollers, as cheap leather frequently cracks in the

flutes, catching at the fibres and forming laps and broken ends. A leather lifting motion should be used which is continuous in motion, and does not rest at either end of its traverse. Many of those at present in use fail in this direction as shown by the deep score on the leather at the top and bottom of the traverse.

Many alterations have recently been made in the construction of the comb to improve its steadiness, and to increase the ease with which the circles can be removed and changed, and the comb of to-day is in many ways vastly superior to the comb of a few years ago, but there is still room for improvement, as all combers will heartily welcome the invention of arrangements which will lessen the cost of the dabbing brushes and the drawing-off leathers.

# WOOL CARDING.

### ESSAY NO. 74.

First we will consider that the stock is in good condition, well mixed and ready for the cards, for it would take too much space to go through the processes of blending, burring and picking.

Now for the carding. We will first take the Bramwell feed. See that the driving belt is clean and tight, then see that the spike apron is put on good, smooth rollers and adjusted so as to run easily; then see that the fly apron is set properly. Now add just the weight for the stock is intended for use, then set the feed apron as close to the feed rolls as possible, so as not to let the stock fall between the rolls and apron. Now we will see that the feed rolls are well covered, true and set to the burr cylinder, snug to a 28 or 29 gauge. Then set as close together as possible so as not to allow the stock to pull through them. See that the tumbler is set to the burr cylinder and the main cylinder snug to a 29 gauge. Now I generally set my strippers first. But before going farther, we will consider the grinding. We will now consider that the grinder is well covered with good emery, not too coarse. I like a fine emery, say No. 10, not coarser, and trued perfectly round. Then see that the chain has the right tension and is not too slack, for this will cause the grinder to jerk and wears the

chain and will cause hooks more quickly than anything I know. Now we will see that the card clothing is put on good and tight, then we will see that bearings are perfectly true and smooth. Now we will set the grinder to a gauge. Before starting up see that both ends are exactly in bearings and the belts are good and tight. Now start up, and see that the grinder runs perfectly smoothly and does not vibrate too fast. Now oil up well and set to the cylinder so that the click will sound like rubbing two pieces of sandpaper together. Then when it sounds just right, not too hard, for hard grinding will ruin more clothing in a few minutes than several weeks' work will come to, stop the grinder and put a smaller roller on the cylinder covered with good stiff fancy wire fastened in the bearings well; then set down in the cylinder about the depth of the wire. Then start up again. This small fancy will prevent making hooks on wires and keeps the cylinder smooth and clean. Now when the cylinder is good and sharp remove the grinder and see that all the top work is in good condition. Now we will first put the doffer in place and tighten up in the bearings. Then see that it turns easily and does not bind anywhere. Then set to a No. 30 gauge to the cylinder. Now we will adjust the comb so that it runs easily and level with the doffer. Now set to the doffer at both ends so as to hear it click the wire just the least bit. Then when started up set after a little so as to run free from touching. The stroke of comb is generally left to the cards according to the stock intended for use. I like a short stroke if possible and fast enough to clear the doffer well. Now we will put the strippers in place on the cylinder, then put in the fancy, lighten up bearings and set to place with a good gauge. Now put on stripper belt. See that this belt is good and tight; set strippers to the cylinder, taking one at a time until finished, then when they are just right, set off fancy so it will clear the cylinder, and put driver belt on. Tighten pulley, run a little and look the machine over and see that nothing is touching the cylinder. Then stop the machine, take out strippers, put on workers and belt; then go through the same process of setting as before. Now put in strippers, put on belts, set strippers to workers and set fancy to cylinder about half the depth of wire on cylinder. Put the stock in the machine, see that everything is in good condition, watch the fancy and see that it has the right speed. There is no general rule that I know of to speed a fancy by. I generally run

my fancy about 5 to 4 of cylinder, but we will leave that to the good judgment of the carder, for it would take too much space to illustrate the different speeds required here for carding different grades of stock.

Now we will go to the second breaker. Look it over with the same care as the first one, only we can set a little closer here, for the stock has been opened up well through the first machine. I think our first and second breakers are the most important, for if we have our stock well carded before it gets to the finisher, we will have very little trouble in making good yarn from condenser, provided all the machines are in good condition. The setting and grinding are all about the same, only we proceed to set at first breaker with back workers and strippers a little farther off; then as we go toward the front, keep setting a little closer till we get to the finisher. This machine can generally be set closer than the rest. In my experience, though, it is not the man who can sit down and write a good essay on carding or other branches of the mill who may win a reputation. As a rule, I think we will need to be more practical and get down to business on the obstacles that confront us daily. It is not a general rule that a carder needs so much as it is practical experience.

Now a few remarks on the setting of ring doffers. First we will see that our rings are in perfect condition, short and smooth. Now see that top and bottom are set and speeded just the same, then adjust the condenser in the proper place and set rub rolls and apron snug. Take up all lost motion and see that all runs easily and smoothly. Speed carding to the stock to be used and you have no trouble in getting good results, both in quality and quantity.

# WOOL OR WOOLEN CARDING.

## ESSAY NO. 75.

Carding for every other textile industry except woolen tends toward the combing principle, which lays the fibres parallel; woolen carding only opens out the fibres loosely and generally in a mixed-up state. It is most essential that the woolen carded roving be even, as there are no other places in the future processes where unevenness can be remedied, be-

cause it is spun into the finished yarn in one process, namely the mule; whereas in the worsted and other textile carding it is followed by a series of drawing processes, which largely arrest any unevenness which might have occurred in the carding.

The writer is of the opinion that the setting of a carding engine is the most important thing in carding. In the first place I am of the firm opinion that grinding periodically is both ruinous to finances (of the firm) and has no good results, card clothing being wasted and only lasting three to five years, instead of eight to ten years. After the card clothing has been put on new, and then properly ground there is very little need for the emery wheel except in case of accidents or misjudgments in setting. There is a better point to be made without constantly grinding, namely a needle point.

In order to get a needle point, the strippers should touch the workers (these are best set by the ear and a slight buzzing sound will be heard) and the fancy as far into the wire of the swift, or large cylinder, as may be without kicking or lapping. The fancy wire set in one-eighth of an inch is on an average sufficient. Also a small stripper should run slowly over the last doffer of each of the first and second parts. This stripper must touch the wire of the doffer also. Lastly the ring doffer should be stripped with wire cover rollers and they also should be set slightly into the wire of the ring doffers.

If a machine is set like this, it will be in better working condition at the end of two or even more years than it was at the end of the first six months, from the very fact that the wire of the card clothing is constantly wearing a needle point and also the wire is being kept well forward and this latter alone is sufficient to do good carding even without point. Some people say, if you have the strippers touching the workers, it will take the point off the stripper. Of course it will, but the point on the stripper is not of much consequence as it is not a working roller, only stripping and carrying, so that if the wire on the stripper is smooth and level, that is all that is required. In order to get this needle point on the American built machine, chain driving must be used for workers, instead of a rope or belt drive. The writer would suggest the setting of the working rollers, worker and large cylinder, and doffer and large cylinder, with the standard gauge, starting with No. 27 for first part, No. 30 for second part, and 32 or 33, or as near as you can get them with touching for the finisher.

# FINE WORSTED PIECE DYES.

## ESSAY NO. 76.

For the making of fine worsted piece dyes a good finishing is of the utmost importance, and therefore I think it will be of great interest to give a description of how they manage this operation in the best finishing rooms in Belgium, the birthplace of this kind of fabric.

If the cuts come from the looms the first thing is of course to see that they are very well mended and burled, and after that they must be perched once more in order to look for spots of oil or dirt. It is good to besmear all these spots with a good deal of oleine, to make them vanish during the washing. The goods thus prepared are put on the washer, and it is very important that they are accurately sewed, lest you have folds which will never, or at least only after much work, go off. These washing machines are rather differently constructed from those generally used over here and therefore I will give a short description: In a large coop of about one yard in height there are two very big wooden rollers of more than one yard in diameter rolling one over the other. Before the pieces, generally four, enter between these cylinders, they have to pass two systems of small perches, one pair a little obliquely over the other, and one consisting of copper, the other of wood. These perches have the purpose of turning the cloth in each direction and of displaying it to avoid those dangerous folds which cannot be removed by the press. Of course there are also two faucets over each piece, one for cold and one for warm water, and also a large one on the ground of the machine to let off the water.

To remove the glue which is in the stuff from sizing the chain, you have to use much lukewarm water and run the goods thus for about one-half an hour. Then you shut all the faucets and give about 50 quarts of soda of 4 degrees Baume and five quarts of soap on each piece. The best soap for these fine worsted goods is surely that which you make yourself every time you need some, taking 25 quarts of water, one quart of pure oleine and three-quarters of a quart of ammoniac. To make the goods of as soft a feel as possible you add afterward some fuller's earth to the bath, but see that it is well dissolved and the solution not too strong. After some time (about one and one-half to two hours) you will see the

soap growing thick and foaming in the coop, and soon after falling down. This is the sign that the dirt is going to be dissolved by the soap. If this does not go on you have to add some more soap until the above-mentioned appearance takes place. Then you have to open the faucets giving lukewarm water, but only a little, until the soap gets foaming again. Now you open a little the faucet on the ground of the coop to let off the dirtiest water, which gathered on the bottom, and shut it again. This operation is repeated about three times, using always more and colder water from one time to another until there is all the water possible pouring down on the goods. It is of great importance that the pieces during the whole washing process are kept very wet, for the same reason we mentioned before. For this same purpose it is also very good to open from time to time the pieces by displaying the lists.

If you see at last that the water going out of the washer is quite clear, the goods also will be clear enough and you may shut the faucet on the ground, and afterward, if the coop is nearly full of water, shut the other ones also. In order to neutralize the last remnant of soda, you give a little acetic acid, but see that this liquid is not too strong, lest it attack the goods unequally. After running the goods about ten minutes, let the water with the vinegar off and rinse once more with cold water. At last you shut the faucet on the ground and take the goods from the machine. It is not good to draw the pieces out of the washer if it is not full of water, because you will easily have spots of dirt in this way, for there is always some dirt in the machine dropping down.

Generally, if enough precaution is taken, it will do to wash the pieces on the washers, but if there are still some folds you must take such goods in the fulling mill and run them for some time with plenty of warm water, giving a little pure, but without using any weights. After this process, of course, you have to rinse once more on the washer.

The goods thus properly washed are taken on the hydro-extractor and then perfectly dried in order to be dyed with an especial color, generally blue or black. The dyed goods are to be rinsed and hydro-extracted once more to get ready for carbonizing. The carbonization is done in a very simple manner. You have a coop filled up with sulphuric acid of 6 degrees Baume, where you put the goods for about ten or fifteen minutes. Over the coop there is a reel whereon you wind the wet

goods and let the acid drop down for some minutes. Then you wring them out on the hydro-extractor (of course another one than the one generally used) as much as possible. Now the goods are dried at a heat of about 75 to 87 degrees, but while entering the machine and drying you have to paint the threads of white or colored cotton, which are generally used for the lists, with a solution of ammoniac (about one quart of ammoniac in 25 quarts of water) in order to neutralize the acid.

If the goods are dried after being carbonized you have to remove the remainder of the acid by rinsing them once more with much warm water on the washer. If you are sure that all the acid is gone—and you know that by smelling, or, better, by tasting the water going out of the washer—you rinse some time with cold water.

After that the worsted piece dyes are treated like all the other worsted goods. I am sure that all the following operations, shearing, brushing, steaming and pressing, are of great importance for well-finished merchandise, but I think they are too well known to awaken any interest.

## CLOUDY PIECE DYES.

### ESSAY NO. 77.

What is the cause of cloudy piece dyes and badly felted woolen goods? In both cases they are put on the finisher at once; the man did not make his soap right, and the goods are not washed clean and much more. No doubt in the first case the goods are not clean, and no dyer, expert or common man, can color dirty goods evenly. Now there is another question to answer: Is the finisher all the time able to get the pieces clean? Very often it is an impossibility with the best soap, and even if the goods run in the washer a whole week the pieces are dirty and greasy. I handled goods as finisher for about twenty-three years, from the finest to the cheapest quality, and many times had the trouble that at once the goods came raggy out of the fulling mills or cloudy from the dyehouse. We spent a lot of time to find out what the cause was, but got no satisfaction until we went back to the place where lots are mixed and found that a poor oil was

used in the picker room, stuff which no soap or anything else would take out of the goods. The oil was full of minerals and acids that killed the soap in the fulling mill, prevented the goods from felting and did not wash out.

Generally all wool piece goods are carbonized after fulling; now the oil of vitriol, the dirt and remains of the oil left in the pieces form another combination which in a heat of at least 180-190 degrees in the carbonizing dryer burns right into the wool fibre. If these pieces come in the dye top for blue no dyer can color them evenly without giving the goods a good boiling out with soda, ammonia, Glauber's salt, etc. Sometimes even then the dyers do not get the pieces clean enough and they are shady, but if the goods are fairly even the color looks dull and dirty and often crocks, and this cannot be stopped, no matter how much acid and salt is used for fastening the color. If we figure the extra labor and material to be used for cleaning, we can buy a good oil and save all trouble. Also all the boiling and handling of the goods so long in the dyehouse makes the goods narrow and boils the life out of the fibre, so that the pieces feel harsh and lose considerable in weight. If these goods had to be fulled they did not run right in the fulling mill either, no matter how heavy I made the soap.

The soap was always watery, and everyone knows that no firm and good felted piece of goods can be fulled with water. Besides, the goods acid left in the shoddy was lying as flocks on the bottom of the fulling mill. Generally I wash goods made out of extracts in warm water and alkali before fulling. There is so much acid left in the shoddy you have to make your soap too strong and heavy to neutralize it, otherwise it turns the soap into water right away. This additional labor is cheaper in the end; if the goods are scoured properly they full more quickly and better and do not lose so much flocks in the mills. To find out if the oil is fit to use, take a handful of wool or shoddy and grease it with the oil used in the picker room, then wash this stock in a solution of alkali. If the oil is all right it forms soap with the alkali and lathers up well. If the oil is not fit to use, the alkali and oil do not turn to soap but to a milk white solution, and these goods never will be right for felt weight or color either. Following is an example: Two pieces are made of the same stock, only No. 1 has poor oil and No. 2 good oil; No. 1 woven was 65.2 yards, 22 ounces.

finished 59.6 yards and 16.8 ounces; No. 2 woven, 63.2 yards, 22 ounces, finished 58.6 yards and 19.3 ounces. Both pieces have been treated the same way before fulling; on No. 1 the oil and alkali did not work together at all; on No. 2 as soon as the alkali came in the washer soap formed. In the fulling mill No. 1 fulled about one and one-half hours longer; the fulling soap was watery and the bottom of the mill full of flocks. No. 2 felted up quickly and the soap was working all the time; it looked white and heavy and formed hardly any flocks in the mill. In the finished pieces there was a difference in feel and appearance like day and night.

For cheap goods oil cannot be good enough. Shoddy is not wool; the life of the fibre is mostly killed, so we have to give shoddy an oil which restores a part of the grease which is in the natural wool fibre and which is taken out of the shoddy fibre because this stock passed the whole manufacturing process once before. I think if the mills are careful what oil they use for picking and also what they use for wool scouring, and especially get no lime in the pieces, there will not be so much trouble for finisher and dyer.

If dirty goods are put on the steamer, some say, the steam blows the dirt out, but I think that is a mistake. The goods are always rolled harder in the centre; the steam in regard to this work comes out more on the ends, and drives the most of the dirt to the selvedges. This is one cause, too, of a light centre and dark listing, or different shades on both ends of the piece and the centre, because the steam has more chance to clean the ends than the middle of the piece. Besides this trouble of dirty goods, there are other things in the dyehouse which, if the pieces are not handled carefully and right, make the pieces streaky or cloudy. Mostly if the goods come wrong the trouble is sought on the end first and the oil is very seldom looked after. Sometimes the oil dealer sends a different oil without informing the mills that he has not on hand what is wanted. The worst thing in such cases is that the mills find it out when the goods are in the fulling mills. Also very often the finisher has to boil up his soap differently according to what is used in the picker house. The surest thing is to try the oil often, as described before. With the right oil and good soap for wool washing a nice felted piece can be made in the fulling mills and the dyer can get a good, bright and even shade. Regarding wool scouring, it is better to use only alkali or any other substitute than poor soap, which contains

lime or any other bad minerals. Natural grease left in the wool the finisher can get out in the washer, but no lime.

## HANDLING TENDER WARPS.

### ESSAY NO. 78.

In weaving tender warps with little twist in them or warps that are weak from other causes, the object to aim for is to have as little friction as possible on the yarns when weaving. To accomplish this, see that the shed when opened out is large enough for the shuttle to pass through without rubbing the yarn. Do not have too large a shed, as it only adds undue strain on the threads. The bottom of the shed should just lie even with the race plate when the loom is pushed all the way back and the shed opened out at full. Do not have it bearing on the race plate. The reason for this is that if allowed to bear on the plate the yarns would be chafed by the action of the lay.

Should the weave happen to be an even one, like a 2-2 twill, or any even weave, care must be exercised by seeing that the whip roller is in line with the harnesses and breast beam. When the harnesses are changing from one position to another, if the whip roll is too high on an even weave, undue strain will be brought to bear on the bottom of the shed, while the top of the shed will have a tendency to be slack. If the whip roll is too low, the conditions will be reversed, causing the top of the shed to be tight while the bottom will be slack, causing the shuttle and reed to chafe the ends.

See that the shuttles are smooth and free from burrs and rough places, also that the shuttle tips are not too dull. The best way to find out if you suspect that the shuttle is doing any damage in this line, is to push the shuttle through the yarn. Any rough places or dull tips will reveal themselves by adhering to the yarn or breaking it. Have the heddles, where the division hooks come, perfectly in line with the warp and reed, also have the heddles working free on the slides. They must not be tight; this is very important on tender warps, yet very often neglected. Heddles should also be greased a little to help them move freely. Weavers should use a drawing-in hook to take up ends. The habit

of some weavers of using their fingers to draw in threads, thereby opening out the heddles to push their hand through, should not be allowed, as it interferes with the warp line and causes chafing of the yarn before the heddles can settle back into their former position. Especially is this so where the heddles do not work freely.

A good help to tender warps is the eccentric gear driven head motion, by means of which it is possible to have the harness change slowly. The head motion should be so timed as to have the quick motion of the cylinder when the shed is open, and the slow motion when changing. This prevents the harness from being jerked from one position to the other, and allows the strain necessary to changing to be more gradual.

Lease rods are a help, providing the warp is straight, and not all crossed up. These may be put in the warp plain, or 1 under, 1 over, on plain or fancy weaves; but where you have a twill, like the 2-2 twill or the 3-3 twill weave, it is best to put them in according to the weave, that is, 2 under, 2 over, or 3 under, 3 over. The reason for this is a more even distribution of the yarn, as these weaves run in 2s and 3s respectively. In putting in lease rods, get them well back. If set too near the harness, undue strain is brought to bear on the yarn. In all cases, have the back harness under the back rod, and the front harness under the front rod. This arrangement allows the same tension to come on each shed, especially with the through and through twill weaves. Someone might say, why put in rods at all? Lease rods, if used as above, allow the same tension on each shed, and if left out would cause more tension on the back harnesses or the ones nearer the whip roll than on the front ones.

One rod put in a warp is a detriment to good weaving, yet it is often done. Some fixers put in rods without any regard to the position of the harness. Better leave them out than do this. The harness should be close to the reed when the lay is back, but not too close to have it strike the harness on every pick. Have it just clearing. The more flexible the reed, the easier on the yarn. Do not have the harness change too early; if you do, you will find lots of trouble on these warps, for the reed will have to push the filling home with the harness crossed over it. Say you have the harness level where the reed is 2 1-2 inches from the fell of the cloth. This condition would bring the harnesses to their destination at

about the same time the reed was driving home the filling; consequently the strain would be very great on the warp. I have known it even to cut the filling or loose twisted yarn. It is better to have the harness level about one inch from the cloth, thereby getting away from the above conditions. There are some classes of goods which, if timed late, will cause the cloth to look bare and reedy, especially worsted dress goods. These will have to be humored by setting as near the above conditions as circumstances will permit.

See that the shuttle hugs the reed all the way across the loom, otherwise it is liable to chafe the yarn. Take out all the unnecessary jar contingent to picking. Have the loom run as smoothly as possible. See that the harnesses are leveled up properly; don't have one side higher up than the other. Have the temples set in close, so they will hold out the cloth to full width. Do not have the reed set out of line with the warp. It must be perfectly straight with the harness and warp, otherwise it will saw down the ends, especially those near the edge. By carefully following the above instructions there should be no further trouble with tender warps, if they are weavable at all.

## WEAVING OF FINE WORSTEDS.

### ESSAY NO. 79.

One of the principal tasks of the overseer of weaving is to deliver as many pieces as possible, that is to say, both he and the loom fixer have to see that the looms are always running. But suppose that the warp is well dressed and in good condition, and the loom is fixed all right, and consequently the weaver is not obliged to stop often for broken threads, there is another thing of the utmost importance, and that is to avoid mistakes. For what can a manufacturer do with plenty of goods, if they are full of mistakes? I think he would often do better to have fewer pieces and those few without mistakes. Of course, it is not my intention to write about mistakes which can be avoided by care on the part of the weaver—for instance, double picks or lack of picks or long breakers, or anything like that—for such mistakes generally can be mended or they vanish if the goods are finished;

but there are mistakes in some kinds of goods for which the weaver is not responsible, or at least less responsible, and which—that is, the worst—cannot be mended, nor do they disappear if the goods are finished. It is natural that such mistakes do not appear very often in goods of minor quality, made from coarse yarns, or, if they appear there, they are not dangerous, as they vanish in the fulling mill; but there are goods made from fine yarns in which they are of more importance. Those goods are especially fine worsteds and cassimeres, and the mistakes I will talk about are little curls or loops.

These little loops generally appear at a distance of about ten inches from the selvedges, and then in considerable number. Of course they are only little curls if the goods are unfinished, for they will be cut through when the piece is on the shearing machines, and will appear as little breaks in the finished goods. They are already visible in the raw cloth on the loom, and it will not be difficult to find the cause, and to avoid them further. If these little mistakes are seen only on one side of the loom, you may suppose that the harness is not fixed all right, one side being higher than the other; in this case you will also have more threads broken on this side. But there may also be another reason; for if the shuttle, once arrived in the shuttle box, does not stop without any motion in the box, a little more filling will come out and make the little curl. Then you have to fix the boxes all right, and the spring which retains the shuttle within it.

But if these dangerous little curls appear on both sides of the loom, you may be sure that they are caused by the shuttles themselves. If the shuttles, for instance, are not quite clean, they cannot stand without moving on the boxes, as the grease or dirt makes it impossible. Also beware of putting any lubricant on the shuttles or the sides of the boxes. But especially take care that the shuttles are quite clean. Also you have to see that the filling cannot get out of the shuttle too freely, and for this purpose you have to put some yarn or waste in the hole where the filling comes out.

The other day we had a cut full of little curls on both sides. They were not all over the length of the cut, but disappeared from time to time, nearly regularly, to make their reappearance after about ten or fifteen inches. At first we looked for the shuttles and the boxes, but the weaver held them clean and all right, and the harness was also in the best

position, so that we could not find any reason. At last we compared the shuttles one with another, and thus we found out that one of them was smaller than the other ones. Naturally this smaller shuttle could not be fixed as the other ones in the boxes, and when this shuttle was taken out to be replaced by another, the curls disappeared. Generally you will not find differences in the sizes of the shuttles of one loom, but this weaver was working on two looms, and as the shuttles were not marked, he had changed two of them. Therefore, I should advise, if you make such goods on two looms, to mark the shuttles of each loom in some way. For it is better to avoid mistakes than to have to repair them, even if that is possible.

## DIFFICULTIES IN WORSTED WEAVING

### ESSAY NO. 80.

We had been running our looms with worsted warps and good bobbin wound worsted filling for quite a time, and everything was going along humming; we were all happy and the weavers were getting good production off the looms, and making good cloth and wages, too.

One afternoon the boss woke me out of my customary nap with a slap on the shoulder. "Look up," he said. "Bill, we are going to put a few of the looms on your section on a new line of goods; here is a sample of them." He held up for my inspection a fine piece of dress goods woven with a plain weave, fine twist cotton warp with two stripes of spun silk about one inch apart. For filling there was one pick of fine French spun worsted, and one pick of twist cotton like the warp. The silk in the warp was matched with corresponding picks of the same material set about the same distance apart in the filling. "It looks as if it would be a good job," said he. To which observation I fully agreed.

In due course of time I had one of the warps tied in the loom and ready for the filling. The twist and silk were on jack wound bobbins and the worsted was spun on a 6-inch cone-shaped tube that was about three-quarters of an inch in diameter at the butt and tapered down to a very fine point.

I asked the boss the reason why the shape of the tube was thus, but he couldn't guess, so I put the shuttles (four of them) in the loom and started off. Well, I think it took about eight or ten picks of the loom to just send that Frenchy worsted cop flying off the shuttle spindle and into the next alley. We both looked at each other and smiled. The boss said: "Better wet the spindle and try again with a new cop." So I put a squirt of tobacco juice on the spindle and tried again. This time we managed to get about two more picks than last time, when off comes Mr. Frenchy again. Well, we didn't smile at each other this time. The boss said, "We will have to take some power off the pick."

I put the power strap up two holes on the picker stick, on the opposite end to the side it was throwing off at, and tried again, with the result that the loom banged off and broke a few ends of the warp out. Well, to make a long story short, we tried about all we knew for making the pick easy. We took off the No. 86 shoe (our looms were old style 72-inch Knowles) and put on one that did not have so short a curve and less of a sharp nose than the 86. That helped some, but did not stop the cop from breaking. Then we tried bending the binders so as to check the shuttle more gradually by putting the swell a little more toward the mouth of the box. That helped some more, but didn't cure by any means, and I imagined it cut the filling some. Then the boss went behind the loom and spit on the crank shaft directly over the shoe and watched for the drop to see what point of the shoe it would strike. It could not have dropped just where he wanted it, for he said, "Put the shoe a little forward and come up on the power strap some, and let the stick in about one-half an inch, so as to get a sweeter stroke. Have the pick start as early as you can and get it without catching on the box where the skip comes." That helped some more and we were doing finely, so the boss went away, saying he would come back in the afternoon. Then I packed that part of the shuttle spindle where the wide end of the tube came, so as to fill out the tube and make it solid. The atmosphere was clearing some, so I left the loom and told the weaver to go ahead as I had another job on hand. I watched that loom from the other end of the room to see when it would stop.

One of our old fixers had been watching the fun out of his weather eye and while I was away he went over and took a look at the loom, so when I came back to see how things were

progressing he said, "Bill, the trouble is with the picker on the end of the loom where the shuttle eye comes. The picker is new, so take it out and gouge a good-sized hole in it about the same size as the shuttle tip. This will give the shuttle about one-half inch farther to travel in the box before being stopped by the picker and allow the swell to check the shuttle more. Also put in a piece of soft packing behind the picker." I did as suggested, and then we watched again, and, sure enough, it did improve. Then as the cops continued to break at the rate of about one every twenty minutes or so, he suggested that we put on check straps, so we bolted one end of a piece of 1 1-2 inch belting to the front of the loom and the other end to the picker stick, about midway up the stick, so that when the lay was pushed back the strap would prevent the stick from returning to its place and the shuttle would strike the picker as the strap was allowing it to slide back into its position, thereby allowing the shuttle a more gradual check. This worked very well and was a good aid, but did not effect a cure.

When the boss came around in the afternoon he sized the situation up again. He said: "Bill, you have done about all that seems possible. You have about turned that loom inside out. I have been thinking the matter over. The filling is very softly wound on the tube and every time the shuttle gets into the box on the eye end of shuttle it receives a certain amount of concussion (due to the shuttle traveling more quickly across the loom than when it is picked out of the box) that starts the cop to give way a little. You will notice that it generally starts to break about the middle, and if you could only manage to get about half way through the cop, the rest of it would weave off all right. Now it seems to me that if we should reduce this momentum and concussion by using a lighter shuttle we would overcome the cop breaking." This argument appealed to me, so I got a set of light shuttles and tried them. I had to put the pick back again to normal to get them to carry across the loom. I took off the check straps and found that the difficulty was entirely overcome and to-day I have ten looms on my section that very seldom disturb my slumbers for cops breaking, and the boss and I smile at each other again.

Moral: Don't use heavy shuttles for fine, soft wound filling.

# CARDING.

### ESSAY NO. 81.

The worsted fabric for men's wear has gradually been replacing the carded woolen fabric, leaving only a place for the latter where it can be made cheaply enough to appeal to those who cannot quite afford a worsted suit. This necessitates the use of low stock for woolens, and makes the carding process all important, as the carding of this stock requires great skill, experience, good judgment and good machinery. Very few card rooms in this country are properly equipped to use low stock to the best advantage. This is a part of the business we have little experience with.

In England, where for hundreds of years they have made goods for the shoddy using world, they have become very expert and their machinery is far superior to that used in this country. There they use four, five and six cards to a set, or use very large cylinders, making it possible to use many workers, and it is the workers and cylinder that do the carding. It seems to me that there is a great opportunity for our carding machinery builders to improve the efficiency of carding machinery by utilizing more of the surface of the cylinder with workers and strippers, and not only give more carding surface, but decrease the open space under the card, from which nearly all the waste is made. With a card built on this plan, I believe it possible to do away with all waste saving machinery under the cards.

The Bramwell feed now in universal use could be greatly improved by being built so as to deliver the stock to the card on an angle like the Apperly feed, thereby having the benefit of mixing and greatly improving the evenness of the work by having about three weighing in the card instead of one as now delivered.

# STARTING UP A WOOLEN MILL.

### ESSAY NO. 82.

The experiences described here happened in a country village. The mill was of the old type, consisting of one stone and several wooden buildings, in good condition, but scattered

over too much space to be convenient. It had formerly been operated on a fine grade of woolens.

There were different men employed as superintendents before the mill was fairly going. The first had good mechanical ability, but his principal difficulty resulted from an imperfect understanding of the grade of goods on which the mill was to be run. The work of getting the mill in shape was entirely in his hands. The future was indefinite to him, and being expected to act, he could only draw on his former experience elsewhere for ideas, which, however, as was found, did not exactly fit the present case.

The mill had no elevator and one was put through the floors of the carding and spinning rooms to the dressing room below and each set of cards turned round, so that the roping came off at the same side of the room at which the elevator had been placed. When the first batches came along, the stock was found to be too long and coarse for the wire and gauge of the cards, the yarns consequently giving trouble in spinning and weaving. By a study of the grade of wool to be used, much time which was valuable could have been saved, by having had the cards and jacks changed over. The elevator, too, when more cards had to be installed, was found to be breaking up valuable floor space, and eventually had to be moved outside the room.

Tiers of substantial yarn boxes were built in the spinning room, which space also was later required for new jacks, which resulted in their being set up in a dark corner on another floor.

The dyehouse was very large and roomy, but at one time had difficulty in handling the amount of material required, and to increase the output new kettles and a machine were added at a large outlay. Later, a better system being adopted, each kettle was operated as many times as possible, and it was found that the additions were unnecessary. Meanwhile a new storehouse for wool had been put up, which expense could have been saved by partitioning off one-third of the dyehouse, taken up by the new kettles.

At another time the picker room was found unable to cope with the work and plans were gotten out for a new building. It was found, however, that the difficulty was on account of small batches, which held up the output of the one large picker in use. It was suggested that a small picker be put in, for which space could be made, to take care of the smaller batches,

which overcame the difficulty and did away with the necessity of a new building.

The mill was driven by water and steam working together; the boilers, being old, were replaced by new ones. Afterward old agreements relating to water privileges were unearthed and the matter thoroughly gone into. It was found that the mill below was taking advantage of the lack of knowledge of the new concern on the matter by backing up beyond its rights, but this being righted, the water power was found sufficient to carry the entire plant during nine months in the year, and the boilers just installed proved under the new conditions larger than were necessary. At this time plans had been made to pipe the exhaust steam from the engine into the mill, but fortunately they were not carried out, as, the engine now being used only occasionally, the exhaust was useless for heating the mill and would not have repaid the expense for any other purpose.

A regulator for the water wheels had been put in previously, the results from which did not warrant the expense while engine and wheels were driving together, but it was a necessity when the water power alone was used.

In the weave room few snags were encountered on mechanical matters; it was equipped with an old style of loom, wider than was necessary for the new class of goods, but did perfect work.

It was desired to have all the looms in operation and to have the other departments work up to the weave room. The weaving and dressing rooms were run close up to the carding and spinning, which, though running nights, were unable to take care of all the looms.

The warps were put in as soon as dressed and when the filling was not ready it was rushed through at night, which made it necessary to "break out" batches on the cards, so that others which were required to run out warp could be got through; this caused considerable delay and confusion in the card room. At once it was seen that the system of working the departments so close up was wrong, and attention being given to the smooth working in the card room, the desired result of a larger supply of yarn was attained.

The work in the finishing room went well from the start. It had been equipped when pile and soft-faced goods were in vogue, and had all the machinery necessary for the work as well as to carry out experiments in any new style of finish called for.

At one stage good results were not obtained from the machine shop. A quantity of work had been planned, most of which was by way of improvements, and the accomplishment of which did not affect the general working of the mill. The new machinist had all the work put up to him at once, and he did not have the insight to see which were the jobs most necessary to keep things moving in the mill, nor the time to study matters out. He worked seven days a week and often nights, doing everything in a temporary way. Had he had more experience or guidance, he could have accomplished more toward the betterment of the plant in regular hours and at much less expense in wages and material.

Several of the difficulties encountered in the earlier days were caused by there being no good accommodation for overseers, and fully experienced men were hard to obtain. There was also only a limited amount of help available, and when an employe was discharged from one department he could generally find employment in another, which made problems for the superintendent of the kind that worry. This was overcome by opening a boarding house and later building tenements for permanent help. The number of help required was also reduced by adopting piecework wherever possible, and thus increasing the result from each employe. It was also a source of satisfaction to the thrifty, permanent help, whose earnings were increased materially and at no loss to the mill.

To those who have encountered only a settled order of things in their mill experience it may seem strange that so many difficulties should arise, but it will be realized that every system was evolved from a beginning in many respects similar to the ones described.

## WORSTED SPINNING.

### ESSAY NO. 83.

There are very few men who really know how to start to set up a spinning frame. I worked under a master fitter in a New York worsted mill of 130 frames, who had set up and fitted about twenty years, from his own account, and after I had worked under as good a man as there is in Rhode Island in the worsted centre for a year I found that this New York

master fitter, although he thought he was up to date in his ideas, through his headstrong, old-fashioned ideas, was almost impossible to work agreeably with. I mention this, because unless the very start is right in setting up a frame it is impossible for the rest of the work to come right, and also if a new frame is put up right in the first place the frame can always be used advantageously, even when new and modern appliances are used on it.

The bearers and ends of the frame are set up from the floor and held in position at first by the plates that hold the lifter chain pulleys, and then the breast beam should be put on next, and fastened fairly tight. Then when the frame is set exactly where it is going to run, the next thing to do is to get the level of the floor of the four corners of the frame, finding the "high corner" first, then level around the frame and when that is done, fasten the ends of the breast beam as tight as possible, after putting wedges under each side of the bearer foot and bringing the breast beam up to "level" to a line on each side of the frame from one end to the other, and just inside the top edge of the B beam. Now, this rule applies to an old frame that is to be leveled up, as much as it does to putting up a new frame, and as to getting a cylinder level, if care is taken to go by the builder's marks it is an easy matter to get the cylinder right, whereas, on an old frame, my experience has taught me that the easiest and quickest way is to get one end of the cylinder just where you want it; then take a block of wood that will just fit between the bottom of the cylinder and the top of the cross cast-iron connection under the cylinder of the bearer. When one end is right, place the block over the cross-section nearest the opposite end of the frame, and then see that the cap of the end cylinder bearing is screwed tightly together, and, unless the bearing is badly worn, you will have each end level enough for practical purposes. Then place the block under the "long end" of the cylinder over the nearest cross-section to the bearing under the middle of the frame. Then, if the bearing is not worn badly there, you will have a cylinder level enough for all practical purposes, although on an old frame, if it is 1-32 or even 1-16 of an inch higher than at the ends, it is an improvement. Of course the best way is to put a line along the top of a cylinder on an old frame as you would use a line on the bottom of the bearings on a new frame. It is an easy way, and practical, especially when the tapes or bands and weights are on, and

the latter should be taken off so as not to pull the cylinder to one side.

Well, now, as to drafting on a frame, there are a great many so-called. Worsted spinning overseers have an idea that the front roll of a frame should be level with the "carrier rolls," and lots of the more headstrong ones think a frame is all right if the roll is 1-16 of an inch lower, but any spinner who has that idea in his head is not a practical man, and is only holding his position through "graft" or influence. If the front roll of the frame was 1-16 of an inch above the carriers, then the front roll nipped the staple right square; but if it was low—I have leveled up some frames myself that were very nearly if not quite half an inch low—surely the front roll was not nipping the end of that roving square, not to say anything of the "bearing down" process of that roving from the time it came through the back roll until the nip of the front roll caught hold of the staple.

In spinning, as in drawing, the conditions under which different grades of wool, mohair or alpaca, or any other grade that is run in "open drawing," whether it is flyer, ring or cop spinning, the best system to use is that which you find after experimenting and finding out just how the different grades will work at their best. When you have done this make a record of it, setting down every minute detail that would be necessary if you wanted to spin the same grade in a year or five years after—draft, twist, length of staple, and if on flyers, the system of washers under bobbins, also the speed of the lifter; and to go back to the drawing of that same lot, the overseer of the drawing should see that the details necessary to work that same lot again in exactly the same way should be on record in the drawing as well as in the spinning. As to the rule of changing on shuttle work in the lifter, the rule as given to me in one of the best mills in the country, and the overseer was as good a man as I have ever seen for making a nice shuttle bobbin, is to take the count, twist, turns and side gear on the end of the frame, and multiply together and divide by the new count and new number of turns multiplied together. This rule I know is practical, from experience, although the rule in "Buckley's English Overlooker" is different.

# WEAVING.

## ESSAY NO. 84.

To make weaving successful at the present time, a man holding the position of overseer should be thoroughly schooled in all its arts. The man who is the most successful, the one who knows the most about his business, works for the best interest of his employer and those employed. Therefore, first of all, he should be a good manager of help and should study the character of each person. Some will do their utmost if they are shown a little appreciation, while others must be spoken sharply to. Deal fairly with each weaver, dispense with all favorites, petty tale-bearers and mischief-makers. Let each weaver have his share of the bad work, because they all come to work with the intention of making a day's pay, and to do it they must take off production and quality. Do not be economical about the waste, or whether it is better to make a little waste and get production, or let the weavers keep bothering and fussing with bobbins that won't weave off. All bad bobbins should be collected and rewound and then brought back to the weavers. Many yards are lost every day by forcing the weavers to weave this and that, when it ought to be corrected in some other department.

Quality and quantity are what make manufacturing a success to-day. Skilled help should be employed. They are of more benefit and make more profit for their employer than any other kind that is hired for smaller pay. The man who hires unskilled help for small wages is simply cutting his own throat. The weave room is full of trouble from morning till night, therefore it needs a man who can use reason and good common sense in settling the difficulties of his help. Each man should be shown he must keep his place and tend to his own work, and not interfere with another man's work unless called upon to do so by those in authority. Weavers should have their filling brought to their looms, empty bobbins taken away, also waste. In perching the cloth, all defects should be shown up, full amount of yards given and recorded. Perch books left open for the weavers' scrutiny promote good feeling and a little freedom of speech, and gain the confidence of all in charge. Always having in mind the word "success," machinery should be cleaned, overhauled and oiled every time a warp comes out, especially during the heavy-weight season,

because nuts, bolts and castings are apt to work loose oftener during this period than at any other.

Warps should be put in right at the first handling, harness straps being not too tight. The reed should be put in so as not to chafe or pull on one side more than another. Each shed must be made equal, not one higher than the other, and sufficiently high to allow the shuttles free passage. Boxes should be kept clean, also shuttle binders. Shuttles should be oiled once or twice a month on the pin that goes through the spindle, and all dirt should be kept from collecting between the spindle and spring that holds the bobbin. A little shellac should be put on the woodwork; under these conditions they will last much longer. Weavers should not be allowed to "yank" their looms (lays) around by the hand wheel on the top cylinder shaft, nor to pound the shuttle binders; it causes a lot of unnecessary trouble. When anything happens to the loom and weavers to their own fixing, the binder generally gets the blame.

Fixers should be encouraged in their work to keep the looms in good running order, and a good plan for this is to pay them so much a day and a percentage on what the weavers make. When their looms are running and no warps going in, allow them to sit down, because when doing so they are generally thinking of some improvement they might make, or they will use their spare time to good advantage in making supplies that could not be done otherwise. Keep a reasonable amount of loom supplies on hand. Those from the loom works are better, cheaper and much handier to work with. A loom full of patches is fit for nothing but the scrap box. On worsted work, looms ought not to be run over 118 picks a minute if good work is desired; on woolen, from 100 to 110 picks a minute, according to the class of goods being woven.

# THEORY AND PRACTICE—PICKING MOTION.

### ESSAY NO. 85.

There are quite a number of parts in connection with the picking motion and they are so constructed and work so peculiarly that anybody writing on the subject or expressing

his views and the way "they" do is sure to call forth a good deal of criticism, even from men who are in the same business.

When loom fixers get together there is generally a good deal of controversy about the setting of a picking motion to get the best results, and it is very amusing to hear first one and then another give his views on the way they think it ought to be done. The theory put forth at these times would not work just right in practice. If loom fixing, as a whole, was done along theoretical lines, it would require a trainload of supplies once every week, and then the probabilities are that no looms would be able to run for want of the fixer's attention to something that was not as it ought to be; in this method of fixing the fixer would always be busy.

To get things as they ought to be would mean a constant throwing away and exchanging of parts and supplies. This would run up a large item in a week's time, and no manufacturer could afford it. Knowledge of theory is all right, but theory with practice is far better. While practice makes perfect is an old saying, nevertheless it is true in some respects. The man who gets the best results from his work is the man who has had the most practice, generally speaking. Of course there are some who pick things up quickly, and two years of practice to these are worth five years to some others.

A man with experience will set a motion with more ease and ability and better results than a man with nothing but theory in his head. The picking motion is one of the principal parts of a loom, therefore not only theory is required but experience gained by actual practice.

It is experience and practice that prompt a fixer to put the shoes just so on the shoe-shaft, and move the brackets up and down, put the picking rolls in a certain place and make his sweep sticks just such a length. It is experience and practice that teach him where to go and what to do when both sides do not start at the same time, and the best move to make to counteract such trouble. Therefore the best way to set a picking motion is to be governed according to circumstances and the amount of gumption and practice put to the best advantage to get the results wanted.

# AN ORIGINAL SUGGESTION.

## ESSAY NO. 86.

I would suggest establishing in every corporation a "first aid" class for the treatment of accident. Cool-minded young men and women should be selected, natives of the city or town. These should be personally instructed by the hospital doctor in the art of proper bandaging of wounds, the applying of lotions, etc. Each first aid, before receiving permission to act, must pass an examination of merit, to be given by the doctor in question, and a badge given him of distinction.

In each department of the corporation where machinery is running and where accident is likely to occur, a young man and woman first aid should be employed, each to attend upon his sex.

A fully equipped medical chest should be in each department, and out of the way of peering eyes, so that no hindrance may be offered first aid in the performance of duty. Nor should first aid leave the sufferer until he has placed the case personally in the hands of the doctor. The doctor might take the time, nature of accident, and name of first aid, placing a mark of efficiency to the credit of the first aid.

The maintenance of the scheme might be arrived at by each worker subscribing five cents weekly. This should allow any injured person to receive hospital treatment free of charge as long as he is a patient in the hospital. The doctor himself should determine the time of his going home; at the same time, each patient should know he is out of benefit.

Entering into detail, suppose a girl had a fit. First aid knows exactly what it is best to do. Another has a finger partly torn off; here again first aid comes to the rescue by properly bandaging the member, to save loss of blood; then there is fainting to be looked after and other attendance, especially upon sensitive people.

A man falls from a scaffold, or falls down the steps and breaks an arm or leg. Here again is first aid on the spot to make it as easy and as painless to the sufferer as if the doctor were present. Look at it as you may, the humane side of the establishing of a class (there need only be, say, twelve in a corporation), would add greatly to the standard of efficiency. Anything, whatever the cost might be, if it adds a benefit, should be taken advantage of, that every emergency might be met on the spot.

# A PROPOSITION FOR A "COMMERCIAL NATIONAL STANDARD OF EFFICIENCY," ITS POSSIBLE RESULTS.

### ESSAY NO. 87.

The time is now when America must exercise her best effort in the establishing of a trade which shall keep her ever-increasing population busy and the solid wealth of the nation an acknowledged fact, when monetary crises shall no longer reflect an unstable basis of finance, but a standard of business integrity recognized by every nation upon the face of the earth.

The proposition is worth a close analysis by the government of this country, also by the "trade." By the "trade" is meant every branch of industry where labor is exploited for the enrichment of ourselves and country.

On the trade depends our existence and national independence, our greatness, our honor, and though we be in the front rank, there is no solid reason why we should not leave every other nation in the rear, establishing for ourselves a world's trade that would bring lasting enjoyment unto the people.

There is nothing under the sun which the American cannot do, if the fiat goes forth that it must be accomplished. Other nations might query, spend lasting time in discussing, but the characteristic of the American is to set about it, and do it.

My proposition is not the vision of a dreamer, a phantasy of the brain, an imaginary castle of greatness in the air, but a practical accomplishment dependent upon a proper system of education.

To my mind, the so-called commercial education of to-day is a miserable failure. The fault lies in the selection of men holding responsible positions, who are not intellectually nor physically competent, but because they are "somebody," the place is found and a good salary requites them. Result—the trade creeps along like a blind horse.

It is morally wrong to deceive ourselves as to the efficiency of our coming young men, who must eventually steer the ship of trade over the rough sea of competition. The gilded youth of theory is not required more than the hoofed hand of the

practical workman. He may be but a poor son of toil, yet in him lies the requirement and the one sufficiency of the nation.

This fact must be recognized, first and foremost, and the man of sterling merit must be rewarded according to a just value of his labor. By so doing, a stimulus is afforded, brains are to the fore, and the result is a standard of efficiency which means the accruing of wealth personally and nationally.

A college tuition bears no relation to commercial education. The paraphrasing of a dead Latin text, or probing into the mysteries of algebra is simply a waste of valuable time. The young man of business cannot afford to stuff his mind with enthusiasm over ball games, football, etc. Every minute is occupied with the acquiring of practical knowledge relative to his profession. He knows there are men in the field great in their line of work, and if he desires to be recognized, he must not only toe the line in the advance, but must go yet more to the front. The college of a business man is the workshop. It is the commencing at the bottom rung of the ladder and climbing to the top, slowly and surely, and when once there he can hold his position.

The withholding positions from these men, giving them to some other "somebody" does an injury to trade which cannot be measured, and not until merit is rewarded by its position can the trade expect to reap the best fruit of its labor.

I suggest laying before you, sir, by your permission, the weakness of your present technical system of education, say in the technical department. Other branches of industry might have been selected, but as your paper is concerned alone in "textile fabrication," my selection of this one specialty may be pardoned. I do not wish to cast any reflection on technical school tuition. Only, I am of the opinion that to be of national service, it is absolutely necessary for them to change their role of study. I will put the question before you in as simple a way as I know how, and I sincerely hope technical teachers will do me the honor of writing their opinion through the medium of our paper, the "Wool and Cotton Reporter." I present myself before an advanced designing class. Each student shall have passed minor examinations—thus qualifying him for his place. Among the many students, some have selected carpet designs, others dress, others hangings, others robe or mantle. These students are supposed to be in readiness for any call should a position offer itself.

A merchant from India, Turkey or Burma requires a selec-

tion of carpet sketches. They must be perfectly national in taste. Nothing English or American, French or German must suggest itself. It must be the equal of native designing, otherwise you cannot expect to do trade. Question: How many can fulfill the requirement, say, of making twelve sketches, purely original, equal in taste and color, to meet the demand of my merchant friend? In proportion to the many, very few. Why? Because the student knows nothing of manner and custom, nor is taught specially for that one particular trade.

The student might make an attempt, but it would be an insult to present an imitation rather than the real thing.

A Chinese merchant invites me to send him sketches for a robe. It must certainly be of the best material. I ask the particular students in robe designing to meet my demand. One makes an elaborate floral design, another a conventional character design, another an imitation of a Chinese design, showing his ignorance of the characters by placing them in false positions, and which any Chinaman discerns, equally as if the Chinaman presented a woven figured fabric with the flower of the fuchsia growing uphill. We would turn from him in disgust; the Chinaman the same. We want their money; they want our produce. They ask for it; we cannot satisfy. What is the moral? Send the American student to China. Let him grow up a Chinaman, design in China, sending home designs on demand. If you want to secure a market —say, in India—send your student there. Let him grow up with them and design there, sending his sketches home on demand.

A technical school cannot possibly qualify a successful designer for the Chinese market, nor yet for the India or Turkey market.

China wants nothing savoring of American or English taste in design. She thinks her own taste much in advance of ours. Here in this instance the American has no business to push his hideous designs upon them, but he has a business to secure a trade by giving them what they desire, and equal to their own talented artists. The technical school fails to do so, but, generally speaking, fits a student to design for many styles, who is, correctly speaking, master of none. To secure the trade of these foreign countries in the making of fabrics, it is absolutely necesary to have our American designer in the country where the special line of goods is required. He perceives certain colors of dress material do not harmonize but

make them look hideous anent the swarthy color of their skin. Even the surroundings must be met, so that our produce shall meet every requirement asked for. This costs money.

A steady trade will refund any outlay a manufacturer might make in having his designer enlist on the spot where the goods are worn or used.

The trade failing to accommodate the rightful demand of foreign merchants must expect a courteous refusal of a substitute, consequently the loss of wealth and influence, which necessarily follow production.

Another simple way of looking at this important factor of proper education in design is: Suppose, Sir Editor, you wanted a special line of fabric woven in Turkey. Harmony of color and character in design are thoroughly Turkish. If a native designer were to present you with a few sketches, and an American designer were commissioned to prepare a dozen sketches for choice, each designer, unknown to each other of your intention to purchase with the object in view of meeting a demand in Turkey, whose sketches would appeal most to you? On the other hand, presuming the American artist had spent two years in Constantinople, having acquainted himself with their art decoration, their passion for certain colors, their choice of figures, is it not possible that the inventive mind of the American designer might conceive far grander conception in design, perfectly in accord with their taste, thus securing for home orders to meet the ever-increasing demand for the right thing? Where, because we do not efficiently post our students, making them masters in one particular style, to meet the pressing demand, we lose the trade, it going to Great Britain or Germany, who already have designers at work in every country where prospects of trade are promised and who are ever ready to oblige.

Look at it from another point of view. We will take the case of a traveler commissioned to push American woven fabrics.

I select China once more, because four hundred millions of people offer chances of trade more than a country, say, of twenty millions. In matters of trade, every nation stands on its own merit as to quality of its production.

We send a traveler, who, in nine cases out of ten, cannot speak the language. Thus he is at the mercy of an interpreter. Second, the traveler knows next to nothing of the composition of the fabric, only that it is cloth. Third, a Chinese merchant

puts into his hand a swatch of cloth. What can he make that for? The traveler is unable to tell him. Fourth, he is a smoker, probably takes a little liquor, invoking conditions physically detrimental to the exercise of a sober mind. Is such a traveler what America needs in the presentation of her produce in the markets of the world? I venture to say, No! Yet in many cases such is the fact. Intellectually unfit. Result—failure.

A standard of commercial efficiency, by which this country might add 25 per cent. to the volume of her trade, is to create a national school of languages for young men, physically strong, clean in habit, practically instructed in the making of the fabric, having at their fingers' ends an answer to price, cost, and time of delivery of any order which might be placed with them.

Not less than fifty pupils should acquire a perfect pronunciation from a native teacher, each language of every important civilized country being taught, nor should the class diminish, but keep up its full strength, so that fifty travelers in China, each competent to engage the Chinaman in his own language, would mean something to the trade; fifty in India, the same in Russia, and each country in Europe—an army of efficient travelers, speaking their own language. Thus the trade of America would be presented under the best conditions which alone will secure unto us their favors, in the face of the present day competition. I have but suggested two propositions for your consideration. There are others equally important, but on the two suggested, I will leave to the consideration of the trade the possible results of a perfectly trained corps of travelers, perfectly trained designers specially set apart for the trade of other countries, which we earnestly invite, guaranteeing a standard of excellence, equal if not superior, to that of any other nation.

## CARDING.

### ESSAY NO. 88.

I have worked in the card room twenty-five years, fifteen years as second-hand and overseer, and I find by experience that for low woolen stock you want your first breaker card

covered with 28-32 steel wire, with fancy a few sizes coarser, set with a 32 gauge, and your second breaker card covered with 33 wire workers and strippers and fancy, a size or two coarser. Your doffer should be put on very firmly and kept to a good point. Now, your finisher should be covered this way for good results: Your bottom feed roll 32 short wire, top roll 28 medium-length wire, leader-in 32 short curved wire, tumbler 32 steel wire, workers and strippers 34 wire, fancy 33 wire, main cylinder 34 wire, fillet ring doffers 35 wire. Set your tumbler leader-in, and set feed rolls, strippers, fancy and doffers, and start your card, and run for as long as you have time, then stop and put in your workers, and set very carefully. Now you come to your condenser. Set your wipe-rolls very carefully, also your rubs, and your cards are ready to start with your weight right on Bramwell and feed gears, on breakers and finisher, for the right weight roping.

Now, if everything is right, you should not have any trouble in starting your set of cards. When the roping is on the mule, take very careful notice. If it looks twitty, find out if it is drafted right on the mule. If it is, then stop your card, and be sure your card is right, particularly your fancy. Then look to your draft on condenser. Work very carefully, and when your roping looks all right, put it on the mule, and you should have a nice even thread. Your fancy should be speeded according to the stock you are running, and on low woolen or satinettes, you must watch every lot. You might get good results with your card set one way on one lot, and for the next lot you might have to set altogether a different way, as there is a great difference in the low woolen stock. You must also see that the card-boys do their part, as they are responsible for the work in one sense of the word. No matter how good a carder a man is, if the card-boys do not do their part, you don't get the best results. When you speak to a card-tender, try and impress upon him his responsibility; then if he does not improve, make a change. One great mistake that mill owners make is in not going through their plants often enough. They should go through at least twice a day; but how many there are that do not get any farther than the office. There are a great many things a carder has to contend with that could be very easily remedied.

# WORSTED SPINNING.

## ESSAY NO. 89.

When the stock has been carded and converted into roving of a required hank or run, it is then ready to be spun into yarn of a required size. The process of spinning is the last in the formation of yarn, and involves two principal operations, drafting or attenuation of the roving and twisting.

In order that the yarn may be as nearly perfect as can be made, the roving should be round and firm and uniform in structure, and of such a size that the required number of yarn may be spun without an excessive draft. Look your roving over very carefully when it comes from the drawing room; see that the roving is as free as possible from short curly fibres called noil, and to get a good spin do not use the roving for three or four days. See that all the rolls are properly weighted, oiled and cleaned. Every roll put in should be examined to ascertain if the covering be level or loose, and also examine the rolls running in the frame once a week to see if they are grooving; if so, the rollers showing even a sign of grooving should be immediately taken out and skimmed up.

There are four methods of worsted spinning, namely, flyer frame, cop frame, ring frame, and also the worsted mule used for spinning roving made in the French system of drawing. This system differs from the English system, because in the French system no twist is given the slivers. It is a rubbing process and the yarn is spun on mules. On the spinning frame the fibres should be all one length and also fineness of quality. The cop frame is more adapted to fine yarn and will turn off much greater production than the flyer frame because the cop frame spindles can be run as high as three thousand turns faster than the flyer frame, but this difference in speed often makes the warp rough and makes more waste on account of the increased flyings, and this is very expensive.

Three kinds of bobbins are used, one with a head on each end and which fills evenly from one end to the other; the tube which requires a double motion; and the bobbin that has a flange at the lower end requiring three motions to fill it. When ordering bobbins, see that they fit the cops properly. There is a shuttle cop used with a bobbin for filling yarn. Care should be given here that the bobbin fits the cop as perfectly as possible. A spinner should give most of his attention

to the making of his shuttle bobbins, to make the shuttle bobbin spinning as good as possible, for all ends that are down for a minute or two mean bad bobbins.

The speed of the flyer is constant and the length of yarn delivered by the front rolls is always the same, unless gears are changed, and as the bobbin increases in weight it travels faster. To regulate this, drag cloth and leather washers are used, the former dragging lighter than the latter. Leather washers are generally used for light counts.

The drag is also regulated by the number of turns the yarn is wound around the wing; the more turns around the wing, the less the drag. To regulate the drag on a worsted spinning frame is one of the most difficult points, and the only way for a spinner to produce good work is to watch his work, because this method of regulating the drag is one of experience and of judgment. On a ring frame travelers are used and heat and humidity play an important part. The condition of the room should be watched at all times, because when the ring is damp it will cause much strain on the yarn, and when too dry the yarn will whip. If the traveler is too light it will also cause the yarn to whip, and if too heavy will cause too much drag and break many ends. On a ring frame the bobbins do not traverse up and down; a rail carrying the rings and traveler traverses up and down. The smaller the bobbin on a ring frame the more revolutions are necessary to wind the same length. The speed of the bobbin is constant, and it is the falling behind of the traveler that causes more yarn to be wound.

Figuring the draft is the same on the cop flyer and ring frame. Have your ratch as much over the length of staple as you can, and have good work. Remember short ratches mean curly yarn.

Rule for figuring draft: Multiply the diameter of the bottom front roll by the stud gear meshing into the draft gear, and by the back roll gear for a dividend, and multiply the diameter of the back roll by the draft gear and by the stud gear meshing into the back roll gear for a divisor. In getting your draft constant call draft gear one. The flyer puts the twist into the yarn, and as the bobbin increases it is dragged around faster on a flyer frame. It is different on a cop frame. The tube with the bobbin revolving around the spindle puts the twist into the yarn. If the bobbins are wound too soft, increase the speed of the spindles, or lower the spindle rail, and

as the cop is stationary on the spindle, by lowering the rail the bottom edge of the cop will be farther from the nip of the front rolls. The method of finding the twist is the same for flyer and cop frames; while the method of inserting the twist is different, it is only necessary to substitute the speed of the bobbin on the cop frame for the speed of the spindle. There are two ways of calculating twist.

The first method is to find how many revolutions the flyer makes to one revolution of the front roll, so if the flyer is turned 3,000 revolutions while the front roll delivers 600 inches, we have 3,000 divided by 600, which equals 5 the twist. The second method, and used on the ring frame, is to first find the ratio from cylinder to whorl and gears from cylinder to roll. Care should be taken to allow for the thickness of the band. Say if the band is 1-8 inch thick, 1-16 should be added to the cylinder and whorl. Example: Diameter, cylinder, 7 inches; diameter, whorl, 7-8 inches; cylinder gear, 30 inches; front roll gear, 112 inches; jack gear, 80 inches; twist gear, 34 inches.

16
7
----
112
1 allowed for band 7-8 in. equals 14-16 one allow for band
---- 15-16
113
----
16

113 divided by 15 equals 7.53.

4 1-2 per cent. allowed for slippage.

.955x7.53 equals 7.19115 ratio.

80x112 equals 8,960x7.19115 equals 64,432.704.

Diameter front roll 4 inches x 3.1416 equals 12.5664.

30x12.5664 equals 376.9920.

64,432.704 divided by 376.9920 equals 170.912, twist constant.

170.912 divided by 34 equals 5 twist.

The twist is largely governed by the length and kinds of wool, and the twist required varies. One good rule is to have enough to pull off the spools without breaking. Having too much twist in the yarn is very costly, because the contraction shortens the yarn and makes it heavier, and the roving must be made correspondingly lighter to make the yarn the desired number, and this is costly because with a lighter hank you have to pay more for making, and produce less. A spinner

should get the length of the staple from the comber and examine the stock often, then when he sets his ratch it will not be guesswork.

# WOOLEN SPINNING.

## ESSAY NO. 90.

The method of making woolen yarn differs very much from the making of other yarns. Woolen yarn is spindle drawn, and it is the combined drafting and twisting action of the woolen mule that gives to the woolen thread its distinctive woolen formation. Before wool can be spun into yarn, it must be carded and converted into roving of such a size that the required number of yarn may be spun without an excessive draft, and to have the yarn as nearly perfect as can be made, the roving must be free as possible from twits and bunches, such as broken burrs and other minute particles of vegetable matter. Generally speaking, there are three kinds of roving, some made from inferior stock, barely capable of spinning the desired run or cut, and roving made by careless persons, cut, rolled, or affected by poor carding, and roving that has been made from good stock, and properly handled in all the previous processes.

The roving should be round and firm and uniform in structure in order to make good yarn. The mule will draw such roving to twice its original length, even more, and with very little trouble. As a rule, the longer the fibre, or better the grade of stock, the greater is the draft that can be given in the spinning. Short stock requires more roving to be delivered by the delivery rolls of the mule for every stretch of yarn. Low stock, with 40 to 60 per cent. of waste or shoddy mixed with it, also necessitates less draft. The carder must make the roving correspondingly lighter in weight to produce the required yarn. A spinner should, with the carder, examine every batch of stock, so that the structure of the fibre and its peculiarities will be thoroughly understood by him. A spinner must know that a curly fibre will make strong yarn, and it is a great aid in spinning, and can be drawn fine and more compact. Always store yarn in a room where the atmospheric condition is normal. This will keep the desired moisture about

14 per cent. The draft should be set to accommodate different batches and kinds of stock. If the draft is not adjusted properly the ends will break often, making more work for the spinner, and also more waste. The longer and coarser the fibre, the quicker the carriage should be drawn out. If the ends break near the delivery rolls, this indicates the drafting is too slow. On fine stock if the roving breaks about half way between the spindles and delivery rolls, this indicates that the carriage is drawn too fast.

The roving-pin gear plate should be fastened with a small padlock in order to prevent anyone from tampering with it.

A spinner should be quick in calculating his roving-pin gear. He should know how many teeth equal one full hole, and how many teeth an intermediate half-hole. He should give about all his attention and care to the draft, to see that it is adjusted properly. Trust no one. Examine your roving. Inquire of the spinner if more ends are breaking to-day than yesterday. Keep on the job. Give great care to your spindle bands. Replace when loose, as they will make soft bobbins, and that makes more waste, and also weak yarn. See that all parts of the carriage will move in unison, and keep your squaring bands tight. Too much attention cannot be given to the delivery rolls. Keep them well oiled, and clean often, because the least friction will make very uneven yarn. The amount of waste made in a spinning room is due to the lack of care with which the draft is set to accommodate different batches and kinds of stock.

The twist required varies. Much depends upon the stock. Yarn made from poor stock requires a greater amount of twist. Twist enough to give the yarn strength to withstand the weaving operation is all that is necessary.

## WORSTED COMBING.

### ESSAY NO. 91.

The comber, on being given a lot of wool to comb, is expected to do several things. First, he must make a good clear top; second, he is expected to make as light a noil as possible; and third, he must take off as large a production as possible.

Before combing machines were invented, worsted yarns were

made of long wools exclusively, as it was thought that fine short wools could not be combed and spun into worsted yarns, and it was to invent a machine that would successfully comb these long lustrous wools that the first inventors of combing machines turned their attention.

The first really successful comb was and is still known as the Lister or nip comb, and hundreds of these wonderful machines are still working and holding their own on long wools which contain a small amount of noil. It is, however, the Noble or circular comb that has come into more general use than any other comb—especially in this country—and this is due to its simplicity and to its ability to comb short fine wool as well as long wool, and at the same time make a light noil. It is the Noble comb, therefore, that most combers have to do with, and the writer proposes to discuss the best ways of running it and accomplishing the best results.

In order to produce a clear top the comber must first of all see that his circles are fine enough for the class of wool he is to comb. If they are not, the neps and shives will slip through the pins, and on the other hand, if too fine, the pins will be very apt to be bent or broken, and also production will be retarded. So that sound judgment is necessary right here at the outset, as well as in everything else in the combing room.

For very fine Australian the writer recommends 40 pins per inch for large circle, and 45 for small circle, and for half-blood, 36 and 40 respectively, while 24 and 28 would do for quarter blood.

The circles must be kept close up and the pins all in and the brushes in good order. In too many cases circles are found running which ought to be taken off and repaired, as a couple of pins out at the same place will result in defective combing.

The speed of brushes is an important factor in clean combing, as it is very important that all the wool be put into the pins at the right spot, and in order to do this the brushes must run quickly enough and sink deep enough into the pins. With the latest dabbing motions it is possible to run 1,000 to 1,200 dabs per minute without undue vibration, so perfect is the balance of the new dabbers.

The pins must also be kept clear of neps and shives, as anything that will spread out the pins is harmful to clear combing. The writer has found the circular brush the best means of keeping the circles clean, it being both simple and efficient.

It is important also that the slivers of wool fed to comb be not too heavy or it will not easily go down into pins, especially if the dabbing brushes are running too slow. For Australian a sliver weighing five ounces to five yards is on the safe side, and six ounces for half blood, and nine ounces for quarter.

In most mills the comber is held strictly to account for the amount of noil he makes, and while this is natural, the writer has seen cases where it would have been better to have made a heavier noil rather than have had the trouble in the subsequent operations of drawing and spinning, for if tops contain too much short stock they are quite apt to make slubby, uneven yarn.

We are speaking more especially of fine short wool just here, which is intended to be run on the Bradford system of drawing, for on the French system short stock is used to advantage. Bad scouring has a great deal to do with heavy noiling as also too close setting on the cards, so the comber is not always to blame for heavy noiling; in fact, all he can do is to set his combs to make the noil as light as possible; the rest must be done in the scouring and carding rooms.

On Noble combs there are only two ways of regulating the amount of noil: the distance the drawing-off rollers are set from the small circles, and the distance the slivers are thrown over the pins of small circle at each feed.

Rollers of small diameter can be set so that the nip will be much closer to circles than rolls of a larger size, but here allowance must be made for possible laps on roller next circle, or a damaged circle will be the result.

Rollers 1 1-4 inches in diameter are generally used on fine wool, and 1 1-2 or 1 3-4 for medium, while for long wool they are 2 and 2 1-4.

Another way of regulating the noil is by the length of the throw at each feed; for if the slivers are thrown further over the small circle pins than is necessary for the proper working of the comb, increased noiling will be the result, but in this case the comb will do a larger amount of work in a given time.

Care must be taken to have the slivers go on to the circles the same way as they leave the card; and the reason for this is the following:

If a sliver from the card is drawn apart, one end will be thin and contain more long fibres than the other, which will be thicker and squarer in appearance and contain more short

stock. No satisfactory reason has ever been given for this; we only know that it is the way the doffer takes the wool from the cylinder of the card, and this fact must be taken into account if we are to get the best results from the Noble comb, for the sliver must go up so that when it is drawn apart by circles the small one will get the square end with the greater amount of short fibres, and better results in top and production will be obtained.

In order to accomplish the above, an even number of operations between card and comb must be maintained. If the stock is backwashed this will count one, and the punch box or balling machine will make it an even number. In the best combing plants, fine wool is gilled twice between backwasher and punch-box; this makes four, an even number, which is correct.

Production in combing is a variable quantity, so many questions are to be taken into account. Speed is the chief factor, and in this also good judgment must be exercised. The writer has found 3 1-2 turns to be a safe speed, with brush running at 950; some again will not run above three, and others again will have 4 or 4 1-2, opinions so differ.

The writer believes in speed for production in preference to heavy feeding, and the improved dabbing motions of Taylor & Wordsworth and Prince Smith & Son have made high speeds far more practicable than formerly.

The weight of the slivers is, of course, an important item in production, and it is not advisable to overload a comb, or poor combing will be the result.

The length of throw at each feed has a great deal to do with production; the longer the throw, the larger the output; but we must bear in mind the noil will increase with each increase of throw, though not in the same proportion. The distance of rollers from large circle has some influence on production, for if full advantage is to be taken of every feed, the rollers must be set as close as possible to circle.

Production of a comb is always reckoned in the amount of top turned off, and, as before said, so many items enter into consideration that it is not wise to state any hard and fast rules as to what production should be. We believe in first of all doing good work, and then as much of it as we can, and so far have been fortunate in being able to work for people who have been satisfied with good work and a reasonable amount of it, but there are firms, unfortunately for the comber, who demand more than can be done and done well.

# WOOLEN CARDING.

## ESSAY NO. 92.

In order that the best results may be obtained in woolen carding, the preparation of the stock in previous processes must be thorough, in scouring, the cleansing of the wool from the natural and foreign impurities that, if not removed, will prevent the wool from being worked in the after processes, and except when the wool is to be dyed in the raw state, proper dyeing is an important process, because wool that is dyed quickly with a high temperature has a harsh feeling, the fibres become stiff and brittle, and the elasticity and strength of the stock are to some degree reduced, and this makes waste in the carding, spinning and weaving. Dry the wool at a low temperature; never mind the cost; you will more than save this extra cost in drying in a low temperature by the waste saved in after processes.

In burring, clean various parts periodically. All perforated wire screens, grates and conducting pipes, if they are clogged up, will weaken the air current, and this will hinder the removal of the dirt from the wool. In setting for a coarse, long staple wool, the burr cylinders may be set farther from the picker cylinder than for a finer and shorter wool, when they may be set up as close as possible without coming together. Set the burr guards as close as possible to the burr cylinder without knocking out the wool as well as the burrs. When set too far from the burr cylinder many burrs will escape them, and if set too near they will pull the wool from the cylinder. Take great care not to allow either the picker cylinder or the burr guards to touch the burr cylinder, because this will soon ruin them.

The proper method of mixing the stock makes the character of the yarn produced. The more that wool is mixed and worked over without injury to its natural qualities, length of staple, and physical structure, the more even will be the yarn. Of course the staple must be approximately the same length to get the best results. In order to preserve the serrations of the fibre from injury during the carding process it is necessary to lubricate the fibres with oil; this oiling enables it to be worked with the least waste possible and the natural elasticity and softness of the fibres are uninjured, but oiling should be carefully done; imperfect oiling results in gummed up cards and uneven work.

Woolen carding has for its object the opening out of fibres of the wool, not so much to lay the fibres parallel, as to mix and intermingle them on a uniform system, so that the fibres will be thoroughly blended with one another. The amount of work turned off by a set of cards varies, because so many factors enter into the results; however, a fair average production for a set of cards 48 inches in width should turn off 300 to 350 pounds of roving per day for 4-run yarn. For a coarser yarn the production often runs up to 500 pounds per day. A 48-inch card cylinder should revolve about 85 revolutions per minute, and may be run as high as 90 revolutions per minute. A 60-inch card should not run faster than 75 revolutions per minute. When running low stock this is too fast, owing to the increased centrifugal force which throws the stock and increases flyings, making more waste.

In setting a woolen card care should be taken to have all belts in place, for if the card is set with the belts off, the settings will be disturbed when they are placed in position, when workers and strippers remove the dirt or flyings from between the bearing and the shaft. In the settings of the various parts of a woolen card the length of the fibre is one important element; the longer the fibre, the more open must be the settings. On the first breaker, the first three workers must be more open, and not try to open the stock at once, because this will many times bend the clothing. The first breaker must be set more open than the other cards, but not too open, because when the wool leaves the first breaker it must be well carded. The first breaker should turn out the stock in a lofty sliver, free from specks or neps as far as possible.

The second breaker card should be set finer than the first breaker card, and the finisher card still closer, in order to card the stock thoroughly. Set one side of the card first, regulating the distance between the rolls so that the gauge will slip between them easily, not binding nor too lose; then set the other side, and keep setting from side to side until properly adjusted. On the first breaker card for setting the feed rolls to each other, and for setting the burr cylinder to the feed rolls, and also between the burr cylinder and tumbler, and between the burr cylinder and burr guard, use a 22 to 24 gauge. Tumbler, workers, strippers and doffer to the main cylinder should be set to 26 gauge. The doffer should be set slightly closer. This can be done by pressing it tighter on

the gauge. The second breaker should be set throughout with a 28 gauge and the finisher with a 30 gauge; ring doffer, 30 to 32 gauge; the wipe roll to ring doffer, 22 gauge. The teeth on the fancy should dip slightly in to the teeth of the main cylinder, say about 1-32 of an inch, and must be set with the belt off. The above settings are not given as absolute, as in woolen carding there is a wide range of variations, and no two conditions are the same.

Judgment must be used in setting cards, taking into consideration the wool being worked and also the number of yarn to be spun. If the setting is too close the wool will be found cut; if too open the wool is not opened, and is liable to roll in bunches. When stripping, care should be taken not to clean two cards of a single set all through at the same time, in order to avoid making a larger number of thin rovings. The first breaker needs more cleaning than the second breaker, and the second breaker needs more than the finisher card. On the first breaker it is customary to clean the main cylinder and doffer one day, and the whole card next day; the second breaker every other day, and the finisher twice a week.

In grinding care should be taken not to have the grinding roll on too heavy or too long, as this will form a hook or burr-point, and heavy grinding is liable to heat the wire and draw the temper. Too much stock should not be forced through the card by speeding up the doffer, nor should the sliver be made too heavy. The quality of the work in woolen carding should not be sacrificed for production. Cards should be frequently cleaned and oiled and all dirt and waste removed from the bearings. All belts should be examined once a week, and all broken or worn lacings should be replaced. A woolen card room should be fitted with a humidifier, in order to keep the air moist, the condenser being troubled the most; although this may often be reduced by setting the apron farther apart and decreasing the traverse, only allowing enough rubbing action to condense the rovings into a round thread. The draft that can be given on the mule depends on the quality of wool used and the size of the yarn being spun. For spinning the required size of roving, use the following rule: Multiply the length of roving, "expressed in inches," delivered by the rolls on the mule by the size or run of the yarn to be spun, and divide by the draw of the carriage, in inches. The answer will be the size of roving required. The aim of a woolen carder should be to give the production of good work,

and as large a production as is possible with the quality of work required, and economy in avoiding unnecessary waste, and keeping down the expense of wages, power and supplies, and keeping the machinery in good condition; for remember that all is in your care, and your reputation is at stake at all times.

## WOOL CARDING.

### ESSAY NO. 93.

In taking up this subject, it is with the hope that some worthy beginner may get something from this article that may be of some help to him. The art or principle of carding is one of the most difficult branches of woolen manufacture. It is the separating of one fibre from another and placing them together again in order to get an even thread. How is this to be done and how am I to give the results required when stock has to be used that was formerly thrown away and burned? True cylinders, with smooth even face, a good point, close adjustments, and a knowledge of your machine and stock are some of the essentials to obtain the goal in view. We will begin by adjusting or putting up a set of cards.

Level your frames and see that they are square and parallel with the driving shaft. Before putting in your cylinder see that the lags are solid by having the bolts tight and snug. After getting your machines together we will turn them up. Before putting the tool up to the cylinder see that the turning rest is level and parallel with the cylinder. Measure each end of the rest from the shaft of cylinder and see that it is square and solid. In adjusting your grinding frame for the smaller cylinders, see that your turning rest is in line with the cylinders also, and care must be taken to have the rest square level and solid, and see to it that the journals run in the bearings, not only when turning, but at all times when grinding. In turning up don't rush or hurry up your turning. Better to run your turning tool several times over your cylinder to secure a perfect job than to take a deep cut at the risk of gouging your cylinder and causing your tool to tremble, thus doing an injury to the face of your cylinder. Let me say right here, a thing well done is better than twice done. Haste makes waste.

Work fast, but don't hurry. In turning and grinding, you are doing work that requires care and time, and something not to be done every day. So, in regard to every step or advance you make, after turning and before cylinder stops, run a pencil mark around your cylinder and get the circumference of same, and divide it off into equal spaces according to number of sheets required. You are now ready to clothe your cylinder. Lay a board across the top of your machine by letting it rest on the arches so you can reach it nicely for holding hammer and a few tacks. Take another board and space it off seven-eighths of an inch apart, and the length of your sheet to set yarn tacks by, and have a boy set the nails just so they can come through the leather. If the cylinder is good and solid (the wood) 12-ounce tacks are sufficient tumbler, No. 34; licker-in No. 28; use 14 ounces or 16 ounces. In ordering wire always remember that you can card coarse wool on fine wire, but you cannot card fine wool very satisfactorily on coarse wire. So in ordering, we will order for the first breaker No. 32, or No. 33 wire for the cylinder, workers, strippers and doffers; fancy about the same number, or, if you prefer, two numbers coarser, straight wire; tumbler, No. 30.

Second breaker, No. 34 wire throughout, except tumbler—let that be No. 32; licker-in, No. 28; fancy, No. 32; finisher, No. 36 wire throughout, except tumbler, No. 34; licker-in, No. 28; feed rolls, No. 28; rings, No. 36, and about one-eighth difference in width between top and bottom, and when you use the Apperly, outside ring should not be less than 1 3-4 inches in width. In ordering, give the diameter of doffers. Also take a piece of paper about three-quarters of an inch wide and measure the circumference exact, and send that along with your order.

When covering the cylinder with sheets, I take two pulleys which I make out of wood, 1 3-4 inch face, 4 inches and 16 inches diameter; bolt them together and fasten the clamp to the small pulley with a strap, and fasten a strap from the large pulley with a place for the foot. To stretch clothing, nothing is better. A shaft 1 1-4 inches in diameter is sufficient to slide pulley. Fasten well to the frame of machine, just leaving room to clear the shaft. You are now ready for work providing you have all the holes nicely filled up with beeswax, putty, or plaster of paris. Beeswax is the best. Care must be taken in putting clothing on, so as to get the stretch out of the leather. If filling is used, place a roller about 6 inches in diameter or thereabouts, and about 4 feet from the floor on

an angle so that the filleting will not climb up on top of each other as the covering of cylinder progresses. If an iron roller, put three turns of the fillet around, then the idler to which the weight is attached to keep the tension even; then turn and fasten tapered end to cylinder, and you are ready for work. If wooden roller is used, two turns, then idler and one turn, and fasten to cylinder. See that your rollers are smooth, and put a little oil on, so that the filleting will slip nicely around without jerking. Have a good large ratchet fastened well on shaft of cylinder, and turn steadily, about 150 pounds attached to idler. Of course, the kind of fillet clothing is to be considered. If leather, just tight enough to take the stretch out; with other foundation, such as felt or any other material, care must be taken. Some material will bear more strain or tension than others. In ordering rings, if one knew what kind of stock they were going to use they could order the rings of such a width that when once set they could leave them there, but that is almost an impossibility, for sometimes you have a long fibre, and perhaps the next lot you could not find a fibre one inch in length. So, in order to get the top and bottom ropes the same weight, you must change the speed of your doffers, or adjust the top or bottom doffers at the risk of injuring your ropes. So, in ordering rings we have to order what will answer for the different grades we are likely to handle, making a difference in width from 1-16 to 5-32 between top and bottom rings; 1-8 difference does very well. When putting rings on a doffer where a creel is used, or some device similar, make your gauge stick so that the outside rings will be inside of wire on main cylinder 1-4 inch. Set the fingers that guide the ropes into finisher with the same gauge you put your rings on the doffer by. See that the ropes enter into finisher directly behind each ring.

Now that we have the cards set up, turned, clothed and ground, we will proceed to adjust them, beginning at the first breaker. I generally say a carder has got to get acquainted, and know his machines just the same as a horseman has to learn his horse. Taking for granted that the cylinders have been properly trued up, clothed, and ground, and that we are going to card fine stock, we will use a 34 gauge, as the man that can get true even cylinders and close adjustments is the man that gets there. I generally carry a 32 and a 34 gauge in setting cards, sometimes a 30 gauge. I might say if it is possible, I like to run a medium stock through full and come down

gradually. If my stock is free from burrs and sticks, I set tumbler up close to cylinder on first breaker; if not, I use a 28 gauge to protect cylinder. When I get to finisher, I set the tumbler as close to cylinder as possible, and licker-in close to that, using a 34 gauge and feed rolls just as close to licker-in as they will run without touching. I have discarded the feed-roll wiper long ago. On short stock I use a lumper underneath the tumbler and licker-in, and set just as close to tumbler as I can get it without touching, and also to licker-in. It should be 7 or 8 inches in diameter, covered with good, keen wire and revolve with teeth pointing toward teeth of tumbler at about 20 or 30 revolutions per minute, and the licker-in cleans the stock of that so any lumps coming on to tumbler go back to licker-in and over again, thus manipulating the stock and giving it in better condition to cylinder. When there is an extra cylinder or breast on finisher, the lumper is not required. The licker-in on finisher should not be over 5 inches in diameter, so as to be able to set it well into the V on feed rolls. The licker-in should be always in the very best condition, so as to take the stock in regularly from the feed rolls. I like to run a small fancy on licker-in 28 wire.

I set my fancy on main cylinder with a 34 gauge, so that it pulls between cylinder and fancy a little snug. In setting your cards make sure that both sides are correct. I mostly judge by my hearing, and condition of stock, but the gauge is a great help. With the proper draught on wipe-rolls and set just below centre of doffer, and rub-rolls set correct, your ropes should come out all right.

In setting the old style of rub-rolls lay a piece of paper or thin piece of leather 1-32 of an inch on the bottom row of rolls and set the top rubs to that. I use a 28 or 30 gauge. No matter what rub system you have, they should not vibrate any farther than the width of your rings. There are different reasons why ropes run together: Sweep too long, aprons too dry, speed of aprons not right, etc. If aprons, look between the front and back apron, and if the ropes are jumping or flitting about, speed up the front apron one or two teeth. Here caution is required between the doffers and spool drums. You must have the proper speed on your wipers. Speed that would give good results on one kind of stock will not give satisfactory results on another, hence a change of one or more teeth on wiper is necessary.

With your belt good and snug, especially your fancy belts

(take particular care of fancy belts and test them occasionally, and make sure they are doing their work), I see no reason why you should not have good results, providing your stock comes to you properly blended, mixed and evenly oiled. The blending and oiling is a very important feature connected with the carding room. If your stock is not properly handled in the picking room, the carder is somewhat defeated in his work. The picking room should be under the carder's supervision, and a responsible man attend to it. Some superintendents or managers seem to think they are doing the right thing if they can push some inferior, short, rotten stock into batches and not let the carder know it. A mistake. The greatest confidence and harmony should exist between the carder and superintendent. The tickets for the different lots should come from the superintendent to the carder, and from the carder to the picker man, and if the overseer in picker room discovers a change in stock he should report to carder, and he should then give his attention to the matter. A carder should be a Napoleon with regard to his work, and become acquainted with all its details, taking for his motto, "eternal vigilance."

Speed of main cylinder, 1,200 feet per minute, should be the limit. Good results can be obtained of a finisher cylinder running 600 feet per minute. Speed of fancy, 6 inches to 5 inches of main cylinder; sometimes 5 inches to 4 inches of cylinder. Fancy wire must not be put on too tight. Torrance ball winder and creel or some device similar between first and second breaker gives best results toward making even ropes. On good wool stock, one-half draught is sufficient; inferior wool, coarser, mixed with shoddy and cotton, two-thirds; cotton, such as comber and cotton flocks and mill flocks, very near full draught. Ropes must not be rubbed too hard. Of course, in all cases care must be taken and good judgment used. A carder must study cause and effect, and aim to become a master of his profession both as a mechanic and in regard to executive ability, taking also for his motto, "Do unto others as you would have others do unto you."

# WORSTED SPINNING.

### ESSAY NO. 94.

The full process of spinning worsted yarns embraces also the drawing operation, which is the preparatory stage of spinning and in which every spinner is more or less interested; for men who can do both drawing and spinning have a distinct advantage over a man who can do only one of the two. For this reason drawing will be included in this essay.

The object of the drawing process is to reduce the tops or slivers of combed wool to an even strand or roving, of a suitable weight to spin with a desirable draft. Draft is the number of inches that is drawn out of one inch; that is, if one inch is drawn out to two inches, it is two of a draft; if drawn out to four, it is four of a draft, and so on.

The principle of drafting between two pairs of rollers of different surface speed is used all through the worsted business, both in gill boxes in conjunction with fallers, and in drawing boxes and spinning frames without them.

There are three types of drawing in general use: open, cone, and French drawing. The first is more widely used than either of the others, though cone drawing is pretty generally used also.

The open principle is suitable for a wider range of work, and for this reason is more widely used. A set of drawing may consist of six, eight, nine, or ten operations, according to the grade of stock and the purpose for which it is intended.

For fine yarns the usual number is nine, and the set may be either a double or single one. A favorite arrangement for a single set is as follows: 1 double ban gill box, 1-2 spindle gill box, 1-2 spindle drawing box, 1-2 spindle weigh box, 1-4 spindle drawing box, 2-4 spindle drawing boxes, 1-24 spindle finisher, 2-24 spindle reducers and six 30-spindle rovers.

The usual practice is to have about the same draft on each box throughout, and about as long a draft as the length of wool. While this is a pretty safe rule to go by in short and in medium wool, it is hardly possible in very long wool, as too many ends would have to be kept running in order to keep up the weight. In order to find the draft of any machine we proceed as follows:

For a drawing box we multiply together the diameter of front roller, four inches; the inside stud gear, 100; and the

back roller gear, 100. Then multiply together the diameter of back roller, 2 1-2 inches; change gear, 32, and outside stud wheel, 83. Divide the first number by the last, and the result will be the draft. This will be better understood by the example:

$$\frac{4 \times 100 \times 100}{2\,1\text{-}2 \times 83 \times 32} \text{ equals 6 draft.}$$

A very convenient rule is to find what is known as the gauge point or constant number, and in order to do this we proceed as before, but leave out the change gear. Example:

$$\frac{4 \times 100 \times 100}{2\,1\text{-}2 \times 83} \text{ equals 192.7 gauge point.}$$

By using the gauge point it is very convenient to find what change gear to put on to give a certain draft on any machine in the set, as we have only to divide the gauge point by the draft required, and it will give the required gear. As, for example, if we want a draft of six: 6 into 192.7 is 32, the gear wanted. Similarly, if we wish to find what draft is on a certain machine, we divide the draft gear into gauge point. 32 into 192.7 equals 6.

In gill boxes the calculation is a little more lengthy, as more gears have to be considered, and the change gear is a multiplier, instead of a divisor; therefore, in finding the proper draft gear, we divide the draft by gauge point, and in finding the draft we multiply the gauge point by change gear. Example:

$$\frac{2 \times 70 \times 70}{3 \times 70 \times 16 \times 18} \text{ equals } \frac{35}{216} \text{ or .162 gauge point.}$$

If we want six of a draft 6 divided by .162 equals 37, change gear; and .162 times 37 equals 5.99 or 6, which is the draft the box would be making with 37 gear on.

Suppose we have a set of drawing as above, and we have to prepare a lot of tops to spin to 40s yarn. First we must decide what will be a suitable spinning draft for the class of stock we are to work, and figure out from this what will be the correct weight of 40 yards of roving to allow this draft.

Say the tops are of good half-blood quality and measure five inches on the long fibres, and the staple is pretty even. This class will stand 7 of a draft in the spinning. 40s means 40 hanks to the pounds, 560 yards is one hank, and 40 times

560 is 22,400 yards to one pound of yarn. As 7 of a draft is to be used, it will take 7 times less than that number of yards to make a pound of roving of the required weight.

Example: 560 times 40 equals 22,400; divided by 7, equals 3,200 yards to 1 pound of roving. If 3,200 equals 1 pound (256) drams, what will 40 yards weigh? 256 times 40, divided by 3,200 equals 3.2 drams for 40 yards. This calculation, though simple, is seldom used on account of its length, and a much shorter one is used, as follows:

If 40 hanks of 40s yarn weigh 256 drams, what will 1 hank weigh? 256 divided by 40 equals 6.4 drams, and this multiplied by the draft (7) will give the weight of one hank of roving. 6.4 times 7 equals 44.8 drams for one hank of roving. As there is no necessity of weighing a full hank, a fraction is taken, namely 1-14 part, or 40 yards, and 1-14 of 256 is 18.3. Therefore 18.3 multiplied by the spinning draft and divided by the counts will give the weight of 40 yards of roving in drams. Having ascertained that 3.2 drams is the proper weight of 40 yards of roving, we will proceed.

Tops of the above quality generally weigh about 4 ounces to 10 yards; at this rate 40 yards will weigh 256 drams. We will run 5 ends up first box and use 6 of a draft. There will therefore be 5 times 256, or 1,280 drams for every 40 yards running up first box, and as we use 6 draft the sliver from first box will weigh 6 times less, or 213.3 drams for 40 yards. We proceed thus with every box and the calculation will show the weight off each box. Example:

40 yds. of top weigh 256 drams.
5 ends up first box

Draft of first box 6)1280

213.6 drams sliver off first box
5 ends up second box

Draft of second box 6)1066.5

177.7 drams off second box
5 ends up third box

Draft of third box 6)888.5

| | | |
|---|---|---|
| | 148.1 | drams off third box |
| | 5 | ends up fourth box |
| Draft of fourth box | 6)740.5 | |
| | 123.4 | drams off fourth box |
| | 4 | ends up fifth box |
| Draft of fifth box | 6)493.6 | |
| | 82.3 | drams off fifth box |
| | 4 | ends up sixth box |
| Draft of sixth box | 6)329.2 | |
| | 54.8 | drams off sixth box |
| | 3 | ends up seventh box |
| Draft of seventh box | 6)164.4 | |
| | 27.4 | drams off seventh box |
| | 2 | ends up eighth box |
| Draft of eighth box | 6)54.8 | |
| | 9.1 | drams off eighth box |
| | 2 | ends up ninth box |
| Draft of ninth box | 6)18.2 | |
| | 3.03 | drams off ninth box or rover. |

By making the above calculation the overseer will know what he is to do before starting, and will be able to correct the layout where necessary. For instance, if the roving is going to come out too heavy, he has the option of increasing the draft on one or more of his boxes, or reducing the number of ends. Or, if, as in the example, the roving is a little light, he may use a couple of teeth less draft on the rover, which would make it about right. If very light he may alter the draft on the last two or three boxes, or put up an additional end somewhere.

We must also consider the knock-off motion, which is attached to every box up to the rover, and in some cases the rover also.

There are two kinds of knock-offs. One is the three-wheel K. O., and the other is known as the train of gears K. O.

The first is always used in gill boxes, and consists of a short shaft with a gear at each end, top and bottom. The top gear engages with a worm on the front roller shaft and lower gear meshes with another gear carried on a swinging stud. Each of the last two gears carry a peg which meet in the course of their revolutions and stop the machine. We frequently meet with men who do not understand this type of K. O., therefore some explanation will be in order.

The idea is to have two gears of which there is no common divisor. If this is so, each will have to go around exactly as many times as there are teeth in the other before they meet.

It will be observed that the gear on lower end of the shaft is nearly always a 29, and the stud gear 43, 59 or 61. It will be seen that no number will divide 29, and any of the three, 43, 59 or 61; therefore, any of the three will do in conjunction with 29. The gear on top of shaft meshes into the worm on front roller and drives the affair, and is the change gear. If we multiply the circumference of front roller by the change gear and by the stud gear and divide by 36, we get the yards contained in one can or spool. Example: Circumference of roller, 6.28 inches; change gear, 48; stud gear, 43 yards in inches.

$$\frac{6.28 \text{x} 48 \text{x} 43}{36} \text{ equals 360 yards.}$$

On the train of gears plan the stop gear makes only one turn when it stops the machine by releasing a spring which acts upon the stop rod. This type is attached to drawing boxes only.

In this case we multiply the circumference of front roller (12 1-2 inches) by upper worm gear 17 lower worm gear 60, and stop gear 60. Also multiply together change gear, 36, and inches per yard, 36. Divide the first number by the second, and we have the number of yards on spool. Example:

$$\frac{12\ 1\text{-}2 \text{x} 17 \text{x} 60 \text{x} 60}{36 \text{x} 36} \text{ equals 590 yards}$$

While the K. O. is useful in any machine, it is indispensable in the weigh boxes, where the yards on the spool or in the can must always be the same. The writer has seen overseers who would spend hours patiently carving or painting the weight of

each spool on its end, when every spool can be made of uniform weight in much less time, by tacking a piece of lead on its barrel, and the weighing also is much handier as a result. The weighing of cans or spools is done for the purpose of making them into sets, so that if one can or spool is a few ounces light, it is placed with one of the same number heavy enough to make up for it. In this way the work is kept of uniform weight throughout.

The drawing operation is important chiefly for the reason that we depend on it to keep the yarn of uniform weight throughout. Also we depend on it in a great measure to keep the yarn of uniform thickness, although the spinning has its part in this also. So great care must be taken in every particular, or bad work will be sure to follow. As before stated, much depends on having a suitable draft, and good judgment is needed on this point. In the example given, a half-blood of fairly even staple and having its longest fibres measure five inches, is given a draft of 6 all through, which we have found from experience to be satisfactory, being a little longer than the stock.

Another very important item is the ratch, or distance between the rollers. This should be about one-half an inch longer than the wool, to ensure that none of the fibres be broken.

Another very important point is the drag under the bobbin, especially in the latter stages of the process. This should be kept at a medium tension, for if too great, the slivers are very apt to be strained into thick and thin places. Various types of drag-washers are used, and the writer has found the following to be a good plan: One leather worker next to iron; then one of smooth, thick paper or cardboard; then two of cloth or felt.

The twist also must be carefully watched, and nice judgment exercised. Beginning with the two-spindle gill box, it should be tried often, and, while it should not be hard enough to injure the top rollers in the next box, it should be sufficient to prevent it from stretching between front roller and bobbin. This is especially important in the last two or three boxes.

Sufficient doublings should also be made to ensure a uniform roving, and the ends must be kept up behind each box if the roving is to be even.

The top rollers must be carefully looked after, and at the least sign of grooving or blistering they must be replaced by

new rollers. They should also be kept clean and well oiled. The carriers should also be kept in place, as they keep the twist in the ends till the last and help to make even work.

Splicings should be carefully removed after passing through the box, or they will make thick places in the yarn. In some mills no splicing is allowed, the sets of bobbins being kept as even as possible, and when one end runs out, the balance of the bobbins are broken up into waste.

As we have now considered drawing pretty fully, we will follow the stock to the spinning stage, which is practically a continuation of the drawing, as the drafting is exactly the same, but being the last time the wool is drawn out, it is a universal practice to give it a longer draft than any other operation previous; therefore, stock that would be given 5 or 6 of a draft in the drawing would be given about 7 in the spinning. However, the spinner is not supposed to know what draft he will need for any particular lot of rovings he is given to spin; he must figure it out for himself. Suppose he has to spin the lot we have been considering in the drawing. He will be told the weight of 40 yards of roving and the counts the yarn is to be spun to, and he must figure out the draft and gears himself. We have said that the lot in question is to spin to 40s, and the weight of the rovings is 3.2 drams for 40 yards. We also know that 40s yarn means 40 hanks of 560 yards each to the pound. There are several ways of weighing the yarn. The simplest is to weigh as many yards as the number the yarn is, which should weigh 12 1-2 grains. This weight is gotten from the following calculation: If one hank (560 yards) of 1s weighs one pound (7,000 grains), what will one yard weigh?

Example: 7,000 divided by 560 equals 12 1-2 grains.

On this basis the numbers run up. For 1s we would reel off one yard; for 10s, 10 yards; for 40s, 40 yards, and each would have to weigh 12 1-2 grains. Some, however, prefer to use a 25-grain weight, and others 50, to insure a more accurate test. The last is very convenient, as we can use four bobbins, and the number the yarn is denotes the number of revolutions the reel must make to weigh 50 grains.

In order to find the draft required we multiply the weight of the roving 3.2 drams, by the counts, 40s, and divide by 18.3.

Example: 3.2 times 40 divided by 18.3 equals 7 draft.

The draft and gauge point of a spinning frame is found in exactly the same way as for a drawing frame, and we give

the specifications as found on the greater number of frames in use. Diameter of front roll, 4 inches; back roll, 1 1-4 inches; inside stud gear, 100; outside stud gear, 83; back roller gear, 100. Example:

$$\frac{4 \times 100 \times 100}{1\ 1\text{-}4 \times 83} \text{ equals 385 gauge point.}$$

As our lot requires 7 of a draft, we divide 7 into 385, which gives us 55 as a draft gear. It must be borne in mind that this is only a calculation, and should be checked by weighing the yarn before we proceed very far with the lot; but it comes very close to the correct gear. The next thing to be considered is the twist; and the usual way is for the superintendent to intimate to the spinner the number of turns per inch he wants in the yarn, and we will suppose he wants 14 turns, which is about the usual amount for a 40s yarn of good quality. We multiply together the diameter of cylinder, 10 inches; twist gear pulley diameter, 18 inches; and front roller wheel, 268 teeth. Also multiply circumference of front roller, 12 1-2 inches; spindle pulley or wheel, 1 inch; pulley driving rollers, 9 inches. Divide the first number by the last, and we have the gauge point for twist. Example:

$$\frac{10 \times 18 \times 268}{12\ 1\text{-}2 \times 1 \times 9} \text{ equals 428 gauge point.}$$

We then div'de the number of turns wanted in this number, and we have the twist gear: 428 divided by 14 equals 30.6, and 31 being the nearest, we put on a 31.

The ratch in spinning, as in drawing, must be set with care, and the same general rule should be followed, but here, being the last operation, we have a little more latitude, and are governed a little by the condition of the yarn. If the yarn is good and even, well and good; but if twitty, something should be done to remedy it. And one of the chief causes of twits in spinning is too long a draft; that is, the rovings are too heavy. Another cause, and a very frequent one, is too much short stock in the wool. Of course, the spinner cannot remedy this, but he can sometimes improve the yarn by closing up his ratch a little, and by breaking a few of the longest bring the back roller a little nearer to the short fibres. This will help matters some, but he must not overdo it, or his top rollers will suffer, and the yarn be made curly, especially on long wool.

The rollers and carriers should also be kept level; if a rule

be laid on the back roller and three carriers, they should all three touch the rule, or nearly so. The practice is to have the front roll 1-16 of an inch higher than the rest.

The top rolls should be watched with the greatest care, as they are far more liable to do permanent injury to the yarn than drawing rollers; and at the least sign of grooving take them out, and don't wait until they begin to make bad yarn. Spinning frames for worsted have three different kinds of spindles: flyer, ring and cap; and each kind has its good and bad points. Generally speaking, flyers are best for long wool, and caps for short fine wool. Flyers make the smoothest yarn and least flyings, but they cannot be run at a high rate of speed; 3,000 per minute may be considered the limit, but we know of mills which do not run over 2,100, their motto being low speed means superior work.

The drag in flyer spinning is the most important item, and they must be changed to suit the counts or stock, as they exert a most powerful influence on the spin. They are made of paper, leather, cloth or felt; and good judgment is needed to tell where and how to use them. A good general rule is to paste a felt or thick cloth drag fast to lifter plate as a foundation; and on this the others can be used as found most effective. The writer has found that leather drags on top give good results, a steadier drag being the result.

Cap spindles are the most widely used in this country, chiefly on account of the high speed they run, at 6,000 per minute being but a moderate speed, and 7,000 and 8,000 being not uncommon. They should be kept clean and well oiled, and the edges of the caps nice and smooth. It is a good plan to drop a little oil into the hole once a week to keep it from sticking to spindle. The drag is regulated on cap frames by raising or lowering the spindle rail, as found desirable. The speed also has a great effect on the tension, the higher the speed the harder the bobbin.

Ring frames are chiefly used for spinning filling to be woven single, and for this are considered good. One great advantage is that in piecing up, the spindle can be held by the knee brake, until the spinner is just about to bring the two ends together; so there is no extra twist at the place, like a similar piecing made on a cap frame. For some weavers this is certainly a great advantage, for these hard, twisted pieces have to be removed from the cloth in the finishing,

which adds to the expense of the goods; and the goods are not as perfect.

In all the above remarks the writer has had in view both the young men who are just starting out to learn the business, and also the older men who may, perhaps, profit somewhat by some of the ideas I have mentioned.

# COTTON CARDING.

## ESSAY NO. 95.

There is a good deal of truth in the old saying that it is more blessed to give than to receive, and my object in writing this article is more for the benefit of young students than for the prize.

To be a good carder and manager of help, a carder must study and make himself thoroughly acquainted with the different tempers and dispositions of help under his charge, and adapt his conduct and proceedings accordingly. Keep cool and good-tempered, and so conduct yourself toward your help as to gain their respect and esteem, and above all never complain no matter what comes up. Be ever ready to grasp the situation, and protect your company's interest, and exercise justice toward all concerned, and keep everybody busy instead of trying to do all the work yourself.

In the management of a card-room, the carder's aim should be to produce good work with as large a production as is consistent with the quality of the work required, and to avoid unnecessary waste, keeping down the expenses of wages and power, and keeping the machinery in good condition. Give the picker-room your attention when making your rounds, and when mixing be sure to sample every bale that is put in the bin, and have the cotton pulled in small pieces, and as each lot of cotton varies, bale from bale, the mixing should be built up in layers, so no two bales of the same mark will come together, and each mixing should be large enough to last at least four days. The picker-room is a department considered too unimportant by many carders, and this is where a great mistake is made, because cotton wrongly blended cannot be separated afterward, and no two mixings are alike, and almost every time that a mixing is changed, changes are

caused in the card or spinning room, and the result is uneven yarn.

The mixing should be as far as possible of cotton of the same length of staple, because it is impossible to set the rolls for two different lengths of staple. Run different lots of staple separately. Although this method requires a little more care, it will be found to be the only way, and less expensive by the waste saved in the after processes, and to make an even lap, the lattice feed apron should be examined often, to see that no slipping takes place, because when the lattice feed apron stops, the spike lifting apron takes up the cotton irregularly. Also watch the automatic boxes; see that they are filled regularly, and do not allow them to run low, and then be filled to the top, because this will cause the same trouble. The lifting apron should travel about 72 feet per minute, and when it is necessary to change the amount of feed, do not change the speed of the apron. Move the comb or spike roll nearer off from the lifting apron.

Below, I give the speeds and settings for ordinary work, say, a forty-pound finished lap. A two-bladed beater, 18 inches in diameter, should revolve 1,500 revolutions per minute; a three-bladed beater, 20 inches in diameter, 900 revolutions per minute; a two-bladed beater, 16 inches in diameter, 1,300 revolutions for finisher. The first three bars point to point should be set one-half inch, decreasing to three-eighths of an inch for the lower bars, the beater blade from feed roll one-quarter inch, and the stripping plate as close as possible, say one-eighth of an inch. The problem of the regulation of the air current is a very important one, and much depends upon it for the production of a clean lap without the loss of good cotton, and also an even sheet that will unwind at the next process without splitting. The first point to consider is the speed of the fan which should revolve about 900 to 1,000 revolutions per minute. It must be understood that this is an approximate statement, because like many other speeds and settings, it must be determined by practical results. The object of the air current is to carry only the cotton fibres and deposit them on to the cages, and at the same time the heavier impurities must be permitted to fall through the grid or bars. If, then, it is found that too much good fibre is deposited with the waste under the beater box, it will be found that either the beater is revolving too quickly, or the grids are set too far apart, or the speed of the fan is so slow as to cause a

weak current of air, or the trunks and conducting pipes are clogged up, thus failing to carry the fibres away before they were permitted to fall between the bars. On the other hand, if the lap from the machine contains too much seed, leaf, or any foreign matter, the causes may be directly the reverse of the above. Sometimes the dampers which regulate the air coming through each screen are either entirely or partially closed at times to obtain good results.

It will be seen, then, that if the beater speed, dampers, and grids are satisfactorily arranged, the speed of the fan would have to be regulated to remedy either of the evils referred to, and the volume of air must be produced accordingly, and if it be found that the sheet of lap is heavier on one side than the other, it will be concluded that the air current on the heavy side is stronger than on the side where the sheet is lighter; therefore, to remedy this, the dampers referred to must be adjusted to divide the current in such a manner as to lay the cotton evenly on the surface of the screens. The area of the dust flues should always be a little in excess of the combined areas of the fan outlets. If the latter have an area of 260 square inches, an area of 300 square inches is about the right one for the dust flues. The most common method is to allow the dust flue to have an exit of three square feet per fan. Constant watchfulness must be given to the cone belts, because when too tight, it will prevent the belt shippers from acting quickly, and if too slack the cone will slip, thus making uneven laps. Always keep the feed rolls clean, because the least amount of stock gathered will make the lap lighter. A carder should keep a daily record of the weight of his laps. Those that weigh, on the standard, lighter than standard, and heavier than standard, should be put into separate lots, and he should distribute the lighter and heavier over among his cards so as to preclude the possibility of getting the work either too light or too heavy. Running laps over again injures the stock, and if a lap is within one pound of the standard, it should be kept in separate lots for distribution. The lap of cotton as it leaves the picker, if carefully examined, will be found to contain fibres crossed in all directions, and a great amount of lighter impurities, such as seed, thin membranes from the cotton boll and leaf, which are too light to have been removed by the centrifugal force of the beaters, or to have dropped through the bars. The card is called on to remove these and to do this requires accurate

settings. One point in carding on which I have always differed from my brother carders, is to have the same settings for all kinds of stock, except the feed plate mote knives, and licker-in screen. When changing length of stock, the feed plate should be changed to accommodate the length of stock run. For long stock, use a long nose plate, and for short stock, use a short nose plate. If a short nose plate is used running long stock, the cotton remains gripped for a longer period than the short cottons, according to their length of staple, and many fibres are broken or injured. The teeth in the licker-in are saw-tooth, and so arranged that no two teeth can possibly follow each other in the same path during the revolution of the licker-in. In this way, an increased combing by the licker-in is obtained, but when the fibres are so short that they become free from, or on the tips of the teeth, it is almost certain to be last at the mote knives. Therefore, the short fibres escape, and are called fly, but the most important reason why the teeth on the licker-in are saw-tooth is so it will not take the cotton around a second time, thus injuring the fibres.

This is the reason why a licker-in should get the most attention, because a dull licker-in will make more neps than any other evil. The proper angle for setting the mote knives is one of practice, and the best way is to try one card on different angles until the correct angle is arrived at, then set all the other cards the same. One point about mote knives is that they are useless to a large degree if a large amount of draft is allowed to enter the back of the card. The back of a card should be packed so that no draft can enter. The surface velocity speed of a licker-in should be 1,000 feet per minute, and of a cylinder 2,100 feet per minute, the cylinder revolving about 165 revolutions per minute. The design and structure of the revolving flat card are to secure the largest per cent. of production possible. With this object in view the manufacturers have decided that 165 revolutions is the limit on account of the centrifugal action on the cotton fibre. The speed of the doffer should be about 90 feet per minute, but the amount of cotton carded determines the speed of doffers to a certain extent. It is now advocated by machine builders to give a heavy feed with quick speed of the doffer. The most important point on a card is the setting of the flats. Here is where the combing is done, and at the same time to remove short fibre and neps as they pass below them when the cylinder is revolving. I have not seen, but I have heard of some carders

setting the flats away from the cylinder at the first setting point, and they call it progressing setting, but as all good carders know that taking the flats away from the cylinder reduces the carding surface of the card, little need be said on the subject. One good point in setting tops is to begin in a proper manner. First examine the cylinder to see if the clothing has become loose or blistered, and see that there is no dirt under any of the flats; then set with a ten one-thousandths gauge. Set one side of the card first, then the other side, then back again until properly set. One point a carder should always have in mind, and that is, to be careful in setting the doffer, and not set too close to the cylinder, because the doffer will act as a stripping roll, and short fibres and neps will be taken from the cylinder, which can be seen in the yarn and cloth.

A large doffer is preferred on a card because it increases the production and produces better work by giving the cylinder a better chance to deliver the fibres through presenting a larger wire surface.

Before proceeding to grind any cylinder, examine it carefully, and see if any teeth are out of place. Level the grinder; then set it almost to touch. Beginners should be careful in setting the grinders until they have acquired the art of grinding by practice. In grinding no special time can be given.

Grinding must always be controlled by sight, ear and touch. If the grinding is done lightly and carefully, the top edges of the wire will be formed something like the cutting edge of a carpenter's chisel, but on account of the lateral motion of the grinder the side edges will be ground off, leaving nothing but the sharp points. On the other hand, if grinding is done in a hasty or imperfect and careless manner, the points of wire are ground in a broader and coarser manner.

Should the grinding be too heavy, the pressure from the emery that this occasions will cause the points of wire to blister, making what is termed a hook. The wire in this condition is detrimental to good carding, and also prevents the cards from being stripped clean, thus increasing the amount of waste. Grind slowly, lightly, and carefully, with due regard to the quality and temper of the wire. Allowing the room to get too cold will cause lapping on the doffer instead of being stripped off by the comb. Lowering the comb will help this trouble, and when the cotton is sagging in front of the doffer,

raising the comb and setting a little closer to the doffer will stop it.

Every card-room should have one stripper to take the lead, and he should have the stripper belt side of the card; pay him a little more and he will see that the cards are stripped properly, and at the right time, and have him examine all the belts once a week. Below I give the settings of a card, 60 grains sliver; doffer to cylinder, 7-1000; flats to cylinder, 10-1000; licker-in from cylinder, 10-1000; feed plate, 12-1000 to 24-1000. Set away for a heavy lap. Mote knives top, 12-1000; bottom, 17-1000; cylinder screen, 21-1000; back knife plate, top edge, 17-1000; lower edge, 32-1000; front knife plate, lower edge, 32-1000; top edge, according to the amount of stripping desired. The closer the top edge of this plate is to the cylinder, the lighter the strips. The next preparatory process to which the sliver from the card is subjected depends upon the character of the fibre or yarn under operation. For the better class of yarn, say, above 60s, the process of combing, previous to drawing, is introduced, and this is called combed yarn, but for the average kind of yarn, drawing is the process following the card, and this is called carded yarn, and owing to the space already taken, I will confine my article to the latter.

The drawing is the last process in which any extensive correction of unevenness of the sliver takes place. If the sliver from the drawing frame is uneven, the resulting yarn will be comparatively uneven. The drawing has two objects. First, to get the fibre parallel; second, to correct as far as possible bad piecing, and any unevenness in the sliver, and in order to accomplish these objects.

The setting of the rolls is the most important point. Light slivers have closer settings, and heavier slivers have wider settings for the same staple of cotton. Slow speeded rolls should be set closer than high speeded rolls, but there is one broad principle that must always be used as a guide in setting the rolls. Every roll must be set so that the distance between their centres will slightly exceed the average length of the staple of the cotton passing through. For ordinary work, say, for a 65 grain sliver, on the drawing set one-quarter inch over staple between first and second rolls; on the slubber, three-sixteenths over staple; on the intermediate, one-eighth over staple. Fly frames and jack one-sixteenth over staple. On the drawings all front rolls should be varnished once a week,

and all rolls should be frequently examined to ascertain if the leather covering be level. If any signs of looseness, irregularity or grooving be discovered, the roller should be immediately taken out and recovered or buffed. Rolls should be oiled regularly, and all bottom steel rolls should be scoured every four weeks. The top roll should never be covered so as to be exactly the same size as the bottom roll in diameter, because it will not be very long before the bottom roll will cut flutes in the top roll, exactly the same as in the bottom one, and these rolls with flutes will draw the sliver or roving differently from those that remain smooth.

A carder should size his finished drawing twice daily, and keep a record for reference. The slubber roving should be sized once daily if it be found to be heavy, and at the same time no variation in the finish drawing sliver; this indicates that the stock is taking twist and must be watched in after processes. Do all changing on the finish drawing as much as possible. Changing draft, gears on fly, and jack frames results in cut roving. If the finished roving, when sized, shows on the heavy side, make your finished drawing correspondingly lighter. It has been noted at various periods in mills how speeders become in a serious state in a short time through the carelessness of speeder tenders, oilers, and fixers. There is considerable cause in speeder tenders and fixers not thoroughly understanding speeds in arranging their commencing and ending of tension throughout the set, and the fixer who understands the winding on problem is a great help and encouragement to either poor or good speeder tenders. On the other hand, if the overseer be careless, and does not size his drawings regularly, or if he will allow his speeder tenders to creel with all full roving instead of creeling half of full roving, with half of half full roving, this will cause slack ends here and there, caused by the uneven work coming through, which cannot be regulated, and many times, all these bobbins running slack bother throughout the set, and the speeder tender, in order to produce the amount of work to make a fair wage, will break the ends back, which, of course, is a loss in wages and production.

Below, I give a few rules and examples which I hope will be of some benefit to the learners. Suppose you were making a four-hank roving and desired to make a four-hank roving with the following gears on the frame: Draft gear, 40; twist

gear, 30; rack gear, 28; lay gear, 16. What gears would you use to make a five hank?

Draft gear calculation 5:4::40x equals 32 draft gear.
Twist gear calculation 5:4::30x equals 24

30 twist gear added

—

2)54(27 twist gear

Rack gear calculation:
5:4::28x equals 22
28

—

50 divided by 2 equals 25 rack gear.

Lag gear calculation:
5:4::16x equals 12 1-2
16

——

28 1-2 divided by 2 equals 14 gear required.

To ascertain the coils to be put on an empty bobbin, multiply the square root of the hank roving, or number of yarn, by 12 1-2. The answer will be the number of coils that should occupy one inch of the bobbin.

To find production on a card, using constant, multiply circumference of doffer by the minutes run, and divide by 36 inches, and 840. Example: Minutes run, 3,480; diameter of doffer, 27 inches.

27x3.1416 equals 84.8232 in.
84.8232 in.x34.80 equals 295184.7360
295184.7360 divided by 36 in. equals 8199.51
8199.51 divided by 840 equals 9.761 constant.

How to use the constant: Divide the weight of sliver in grains into the constant for one yarn, which is 8.33. This will give the hank carding. Divide hank carding into constant, and multiply by the revolutions of the doffer per minute, will be the production 100 per cent.; weight of sliver, 52 grains.

8.33 divided by 52 equals .160 hank carding.
Rev.
9.761 divided by .160 equals 61x13 equals 793 pounds.
Doffer

To find production on all speeders: Rule.—Divide the hank roving into the number of spindles on the frame, and multiply by the number of hanks turned off. Suppose you were

running four-hank roving on a frame 160 spindles, and the frame turned off fifty hanks, what would be the production? 160 divided by 4 equals 40, constant; 40x50 equals 2,000 pounds.

Again, if all your speeders turned off 1,200 hanks, 1,200 multiplied by 40 equals 48,000 production. To prove the above, we know that it takes four hanks of four-hank roving to make a pound on one spindle. So one hank would make .25 of a pound on one spindle; .25 multiplied by 160 equals 40 constant. If the room contained frames with 176 spindles each, 176 divided by 4 equals 44, would be the constant.

To get your average hank: Divide the total number of hanks turned off into production, and divide into average number of spindles. Suppose you turned off 38,987 pounds off 13 frames, with 192 spindles, and 17 frames with 176 spindles. What would be your average hank roving? First find your average spindles.

13x192 equals 2496
17x176 equals 2992

30 5488 divided by 30 equals 182.93

Total hanks turned off 1104.

38987 divided by 1104 equals 35.31

182.93 divided by 35.31 equals 5.18 average hank.

# WOOLEN AND WORSTED WEAVING.

## ESSAY NO. 96.

This subject naturally divides itself about as follows: First, an introduction taking up the general history of weaving; second, the principles underlying cloth construction; third, the mechanism used in cloth construction—the loom, and fourth, the process and details of the work.

I judge, however, by the rules of particulars governing this contest, that the last mentioned phase of the subject is the only one that is cared for, and shall confine myself to the process and details of woolen and worsted weaving, and at once get to the subject.

We shall assume that the warp has come from the dressing room properly dressed, on a beam that is perfectly true and right in every way.

We will place the warp on the drawing-in frame, being very careful not to break any of the threads or damage the warp in any way, and after putting up the required number of sound, well-oiled harnesses, with heddles that are not worn out at the eye, or bent at the top, and no more of them on a harness than are needed, and after we have looked to the harness shafts to see that they are straight and properly fastened at the ends, and also to the harness shaft hooks, to see that they are all screwed into the harness frames the same distance, so that the eyes of the heddles after the warp is in the loom shall be in an absolutely straight line, and that the heddles themselves may be easily separated when the weaver has a thread to put in, we will instruct the drawing-in girl in regard to the draw, and caution her to be very careful about leaving any extra heddles or making any cross draws. We will then pick out a reed with the required number of dents to the inch, looking to see that the wires are all perfectly straight, and in proper place, and then mark in a plain manner where the girl shall begin the reeding. The object is to have the warp exactly in the middle of the reed, and the starting point is found by subtracting the width of the warp in the reed from the entire length of the reed and dividing the remainder by two.

After getting the drawing-in girl provided for we will next turn our attention to the loom that is to receive this warp. We shall assume that the loom is in ordinarily good condition, for there is a limit to the minor details even in an article of this kind. We will, however, take a look at the shuttles, and should any be found with rough points or slivered bodies, will have them smoothed. It is also a good plan to oil any places that it is hard to get at when a warp is in the loom, and also to dig out any oil holes that may have become clogged. It is also now a good time to take a look at the stop-motion, and in fact to give the loom a general inspection, looking for loose bolts, badly worn gears, and anything that is liable to give way and cause damage while the loom is running. After satisfying ourselves that the loom is in absolutely perfect condition, we will tie back all harness straps and wires, that will not be needed, to the frame of the loom where they will not be dangling in the way and getting mixed up with those that are working, and put on the required gear for the number of picks called for.

The chains should now be put on, and it will often save lots

of trouble later to give the harness chain especially a close inspection. It should be properly built, according to the draft, of course. There should be no crooked bars, or broken risers. The links should all be put on uniformly, preferably with the leading end on the outside, rear end on the inside, and, of course, should all be perfectly straight and not badly worn. If less than 18 harnesses are used there should be some risers put on the back of the chain, enough to make it balance well. It is well to put the same number on each bar, and have them engage the same jacks or vibrators, all through the chain. This prevents any working back and forth of idle vibrators. If the sinkers have become worn, so that they do not fill out the bar, small metallic rings should be put on or about the middle of the bar. Two small rings in two different places are preferable to one large ring. This keeps the risers from slipping to one side, and engaging another vibrator than its own, thereby causing harness skips. Never use old reed wires for chain pins. This is an economy that does not economize. Buy the best, and be sure the ends are well bent so that they cannot fall out.

The box chain should be built to give as easy a motion as possible, and at the same time distribute the filling well. In plain fillings, on woolen goods especially, it is a good idea to build the chain so that the shuttles will not all run out even. This avoids the rows caused by changing all the shuttles at the same time. On fast running worsted looms it is well to use the box motion that raises or lowers a box on alternate sides each pick. This is an easy motion and distributes the filling well. The general remarks in regard to straight bars and links, broken risers and pins apply to the box as well as the harness chain. In putting on the chains start the first bar of the warp even with the first bar of the filling chain, and after fastening the ends together, give a few turns to see if they move freely.

Before lifting the warp into the loom, we will look well to the beam heads, sandpapering away any rust or roughness. We will then cut a smooth piece of heading just wide enough to fit into the groove of the beam head, sprinkle well with black lead and tie around with the lead next to the surface of the beam head groove, leaving an end of the heading long enough to tie to the friction band after the warp is in the loom. This prevents the knot in the heading slipping around under the friction band, thereby causing uneven weaving.

This implies that care should be exercised in putting on the friction bands not to get the heading knot between the band and the beam head.

The warp being properly prepared, we will now lift it into the loom, exercising care not to break any threads, jam the reed or smash any of the harnesses. Now hook the harnesses to the upper harness straps in their consecutive order, exercising care not to get any of them crossed, or it may mean a broken jack and lots of trouble. It is now time to put on one friction band, weighted heavily enough to hold the warp firmly, while the ends are being worked through to a uniform tension, and tied to a leader of cotton duck, that winds around the sand roll and is long enough to take a couple of turns on the lower cloth roll. In tying on the warp we will avoid any unnecessary waste of yarn by having the ends no longer than they need to be. In putting the reed in place we will aim to get it exactly in the centre, will tip the top of the reed back toward the harnesses until the lower side slips into the groove in the lay where it belongs, and then proceed to tighten up the bolts that hold it in place. After these have been tightened enough to bring the top of the reed on a line with the groove in the reed cap, then drop the cap into place and tighten, being careful, however, not to force it down hard enough to spring any of the reed wires. Now finish tightening the reed at the bottom, and then we will turn our attention to the selvage.

The selvage, we will find, has been drawn either on the same harnesses as the warp, or on extra ones put on especially for that purpose, according to the fabric to be woven or the results to be obtained. In either case we will take the two outside selvage threads and draw them in, one in each of the two small selvage harnesses provided for the purpose, and a part of the loom itself, and not to be confounded with the large harnesses. The object in thus segregating these two threads is twofold. First, inasmuch as these special harnesses cross every pick they catch every thread of filling at the outer edge of the selvage, thereby making a uniform symmetrical selvage. Second, these harnesses are adjusted independently of the other harnesses, thus making it possible to change, or have them cross much earlier than it would be practicable to have the large harnesses change or cross. The advantage gained is to save a great many "filling kinks" when running on work that is susceptible to them. It is now time to see to the levelling of the harnesses, for although they have been

hooked up temporarily, we have not as yet so adjusted them that when the shed is opened for the passage of the shuttle, the threads forming the lower part of the shed shall lie parallel, and barely touch the race plate at both sides of the warp. The height to hang the harnesses depends upon the weave that is to be used, being a little lower for filling backed and doeskin weaves than for either even or filling faced weaves. We found, when we put up the warp to be drawn in, that it was necessary to unhook the harness shafts in order that the heddles might be moved about freely, and now is a good time to hook these shafts up again, but care must be exercised in doing this not to so hook any of them that any heddles shall be thereby pushed out of place. We have looked to the manner in which the harness wires are attached to the jacks, and have found that the first three are hooked in the first lowest notch of the first three jacks, the second three in the second notch, etc.

The wires that come from the bottom of the harnesses must be hooked to correspond with those above. The idea is to give the harnesses as they run back from the first a gradual increase of sweep in order that the threads, as they extend from the harnesses to the cloth, shall lie parallel in both the upper and lower half of the shed. We will also notice that the size of the shed may be regulated, so that the shuttle shall just have room to pass through freely, by either raising or lowering the harness wire heddles on the jacks. After looking well to the low wires to see that they are perfect in shape, we will hook them to the lower part of the harnesses, drawing them snug, but not too tight, exercising care not to get any straps crossed, and making sure that the curve of all the harness hooks is straight with the harness frame and not crosswise. Right here let me remark that the harness straps on top of the harnesses should hook directly to the harness hooks, and these hooks should be screwed into the harnesses so far that the strap cannot be hooked without giving the point of the hook a quarter turn. Do this and there will be no trouble with the harness straps becoming unhooked or screws pulling out.

And right here let me say that it is poor economy to buy cheap picker sticks or loom strapping. The best is none too good, and will pay in durability, the time saved in replacing, and the smaller breakage of other parts of the loom.

The temples may now be adjusted, and if the warp is a heavy one, on a hard weave, it will be important to have the

Hardaker pattern. On light work the Dutcher does very well, but not for heavy. Should the cloth to be woven be a fabric that pulls hard on the temples, and yet is made of rather tender filling like a Tricot cloth, for instance, it would be well to tip the point of the temple a little toward the reed. This causes the temple to take a smaller bite on the cloth and reduces the chances of a tear down at the point of the temple. After putting on the other friction band, and weighting down the warp beam as much as in our judgment will be required to put in the picks, we will put the loom on one shuttle, and weave in a heading. This heading will consist first, of two or three inches of some dark color, after which we will put in all the threads that we can find out, then weave an inch or two of white. The white will be apt to show up any cross draws and other things that cause imperfections that may have been made. These we will fix, and then dropping all the harnesses, raise them one at a time to see if there are any more wrong draws or threads out. Another inch of white will show us whether the places "fixed" have really been fixed or not, and then we are ready for the regular filling. This is a good place to remark on headings in general, that it is well to weave in headings of yarns that are as near as possible the size and quality as the filling used, for on woolen goods especially, a heading that is composed of different size or quality of yarn will either pull faster or slower than the rest of the piece, causing a corrugated effect for a half yard or so on the end of the piece that damages it badly. When a warp is first started up, especially if it is a heavy one after a light one has been in, the loom will probably begin to show off all the tricks that it is capable of showing. A few of these will be considered, with the ordinary remedies therefor. Should the shuttle fail to pass through the shed and safely into the box when the loom picks, look to see if the shed opens wide enough for the free passage of the shuttle. Do the sticks both strike absolutely together, and at the proper time? Do they have the same sweep and the proper amount? Are the shoes, picker arm and picker balls in proper position and not too much worn? If these are all right, and the shuttle still fails to make the entire trip in proper time, then lower the power straps on the picker sticks until power enough is obtained to throw the shuttle across properly. Of course, the binders must not be too tight or improperly bent. If the shuttle gets far enough into the box to keep the protector from striking, the

binders should be loose enough to allow it to slip in its whole length, so that the point will not catch on the race. Never drive the shuttles any harder than necessary, for it requires power, wears out pickers, and is apt to knock off filling, if the bobbins are a little soft. Now if the shuttle should begin to fly out, we will see if the shed is wide open when the point of the shuttle enters it. Of course the warp is neither too high nor low, and the picker stick strikes at the proper time, for we have already given the matter our attention. We will see if the boxes are exactly on a level with the race, also notice if the ends of the reed bulge out toward the race enough to hit the shoulder of the shuttle, and throw it from its course. Has the picker got a deep hole in it, caused by the striking of the shuttle? This should be remedied. The shuttle should wear a hole directly into the picker, and if it should be discovered that the shuttle was apparently making a notch in the upper part of the picker, that would be evidence that the boxes were dropping a little too early. If the notch is on the lower side, then the boxes are rising too early. Perhaps the picker has worn a deep notch in the stick, or possibly the box motion is so late that the picker begins to strike before the bores are settled in place. Be sure the packing back of the picker is large enough to hold the picker out to place, then have the picker strap just long enough to reach from the stick to the picker, but no longer. The box guides should be tight enough to hold the boxes steady, but not tight enough to bind. Sometimes when a loom is on a hard weave it is necessary to stiffen the spiral spring on the box rod, as the beating up the pick gives the boxes a jerky motion unless the spring is stiff enough to control it.

The danger from harness skips has been reduced to the minimum by the care we have exercised in the building of the chain, but if the loom does make skips then look to the offending jack or vibrator, and the tightening of a rivet or "trueing up" of a lever will probably remedy the trouble at once.

If our loom is running with a "positive" take-up, it will be well to instruct the weaver to keep just weight enough on the warp beam to put in the picks, and not strain the warp by putting on more weight than is necessary. Should the cloth weave up slack, however, it is evidence that there is not weight enough on, and more should be added. With the warp now fairly started, we will turn the work over to the weaver, giving

him or her a final caution about letting threads get out, or mispicks get by, and calling attention to any peculiarities of the work that may need especial attention. After about two yards have been woven we will look through the cloth, holding the end up to the light, to see if there are any imperfections that have hitherto escaped our notice. With this final inspection we turn our attention to other work. Some mills employ an inspector, whose business it is to look over the warps, by raising the harnesses one at a time, at stated intervals. This practice has the effect of making the weavers a little careless about making wrong draws, as they think that any mistake they may make will soon be discovered by the inspector, or in case he fails to see it they, at least, are relieved of the responsibility. The warps should be looked over, but by the weaver himself, and then there is no divided responsibility in regard to wrong draws or threads out.

When the cut is woven and put down by the perch we will find the first end and throw it over the perch back up, and taking our position underneath, with the cloth between us and the window, will proceed to mark all threads out, coarse and double threads with chalk, making a distinct V at either end of each imperfection, thus (———). Each mispick or broken pick should be distinctly boxed in with chalk marks. After pulling over the entire cut and marking all the places we can see, we will again throw the cut over the perch, but this time with the ticket end first and the face up. This time we will take our position between the window and the cloth, and after giving the ticket end a rigid inspection, will look for any imperfections that may have escaped our attention before.

The object, of course, in looking over the last end of the cut so carefully is to detect any crossdraws, threads out, wrong draws, double or coarse threads that may be running, in order that they may be fixed in the loom at the earliest possible moment, and not be allowed to run any longer than absolutely necessary, for the mending of these imperfections is a slow and expensive work.

A book might be written on the minute details of weaving and loom fixing, but that would exceed the scope of the work and must necessarily be left out. We have taken up the more important points of the subject, and endeavored to make them plain, but relying upon the readers' common sense and a certain amount of knowledge of the business to supplement a necessarily short and brief description of modern methods of woolen and worsted weaving.

# WOOLEN SPINNING.

## ESSAY NO. 97.

It would be as well to describe in a few words the difference between woolen and worsted spinning. The drafts in worsted are regulated between the front and back rollers. By draft we mean that every inch that passes under the back rollers will come out of front rollers six, seven or eight times longer, or whatever the draft is, that will be the amount drawn out. The draft in woolen spinning is entirely different from that previously mentioned. We haven't any front rollers to do the drafting in woolen spinning. The draft is done from the carriage of the mule; the drums on which the roving is placed deliver the required amount of roving through the rollers, the end being fastened to the spindle on the carriage. This carriage, being close to front rollers at the start, then moves out to the distance required, say, for instance, one-third of the way. After this the rollers are stopped, and the carriage continues to travel full distance, or other two-thirds of the journey, giving us a draft of three, because one yard has made three, the twist being placed in the yarn at the same time as drafting. This is somewhat different from worsted, owing to the latter being twisted and wound after drafting.

On the return of the carriage to the starting point, the yarn is wound on the spindle, tube or bobbin, as the case may be. We have two wires, called fallers, running the full length of the mule, which regulate the winding of this yarn. In order to start this yarn winding, the spindles have to be reversed, allowing a few inches at the top of the spindles to be unwound; this slack yarn is taken up by the fallers, then wound, the fallers taking an important part by allowing the yarn to be wound in the proper place of the spindle.

The twist is calculated the same as on worsted systems, that is, having a suitable number of revolutions of the spindle per minute. These revolutions, divided by the delivery of yarn per minute, will give the amount of turns in one inch of yarn, providing we have no lost power from dirty spindles or slack bands. All roving delivered from the condenser has been rubbed by rubbers, and as wool has a tendency to stick together, this acts as a twist in the slubbing before being placed in the mule. All roving must be made to suit spinning and not spinning to suit roving. We have several grades of

wool spun on mules; some spinners use mules for spinning very fine short wools, while others use mules for spinning carpet wools, with very long staple. All machines have to be adapted for these wools. It would not be advisable for short wools to follow long wools through these machines without overhauling the machines. We have two other kinds of spinning which are something similar to the woolen system, that is, the French system, and cotton spinning on mules. An overseer, being practical in one, could not advantageously handle other branches without obtaining additional experience.

## THE SELF-ACTING MULE.

### ESSAY NO. 98.

There are various machines used in the cotton industry which from time to time come up for discussion, and to my mind there is no machine throughout the whole mill that gets discussed more than the mule. This is chiefly because there is no other machine in the mill where the spinning is intermittent. The first thing for an overseer or second hand to look at, on going to a new job, is to see that all the mules are in line, and well squared. If not, he is bound to have trouble with bad filling, either too many kinks or the threads snapping off when the mule strikes the beam.

After he has seen that all the mules are in line and well squared, the next things to draw his attention are the backing-off and drawing-in frictions. An overseer cannot pay too much attention to these two parts of the mule, especially the drawing-in friction, as it causes more mischief in a mule than any other part that I know of. If it slips when the mule is running in, you are going to get kinks in your filling, as you don't get the same revolutions on the spindles, every time the mule is engaged in the winding process. In the second place, if it is set too keen in the dish, there is going to be trouble, both when the mule gets out on the holding out catch, as it will not strike out the same every time, and also when it strikes the beam, because of the momentum on the spindles. Always have your drawing-in frictions working well with the backing-off frictions; if not, you will see the square lift up a

little when the faller locks for the inward run, and it also has a tendency to break the quadrant chain.

Another thing an overseer wants to look at in the drawing-up friction is to see if there is too much play between the bottom step and the friction, as this causes a great deal of trouble with the carriage rebounding. If I get one that way I take out the friction and put in a washer on the bottom of the wing shaft, and it always gets me out of my difficulty. Always see that your steel rollers are in good shape, and well oiled, and never let a mule go over a month without having the rollers thoroughly gone over. If any readers would like to ask any questions relating to mule spinning, I would be glad to answer them to the best of my ability. Or if anyone is open for a discussion on mule spinning I would be glad to accommodate them.

## MULES.

### ESSAY NO. 99.

Why do mules get out of square?

This is a simple question to ask, but it is one of great importance, as a mule that is always out of square will not produce as good work as one that is kept pretty well in square with the roller beam.

The next question is, How are you going to keep it square for any length of time? Now, as we are all aware, there is a back shaft scroll band on the large majority of mules and this is one of the most important things to see to in regard to the squaring of a mule. For instance, if you square up a mule first, without seeing that this band is tight, you are going the wrong way about it. Again, we will say you measured the distance from the top of spindle to front roll and the measurement was 7 1-2 inches, and then you went and tightened up the back shaft scroll band and ran two or three stretches and then stopped and took the same measurement again. You would find in the majority of cases that the mule was half an inch nearer the beam than it was against the head. Why? Well, the more even tension you get on your back shaft scroll band the more even run in you will get on your mule, as this band is really a governor of the other bands. I have also

found out by experience that it is better to square a mule one-eighth of an inch farther out on the ends than it is against the head, as we all know the ends of the mule are light and always start on the run in before the head, but not so much if the back shaft scroll or steadying band is kept at a good tension. I have charge of fourteen pairs of mules and I think there is no mule in the State any longer than these, as they are 2,000 spindles to a pair and 1 1-4-inch gauge, which is quite a long mule for this country, but I never have much trouble with their being out of square except when there are new bands put on. Why? Simply because I make my section hands attend to this one little thing, the steadying band. I think I have said enough at present just to show the necessity of this little thing, and I should be pleased to answer any questions to the best of my ability regarding the same.

## COTTON SPINNING.

### ESSAY NO. 100.

Cotton spinning is the process done either by the mule throstle or ring frame. I will take the mule first. The carriage of a mule should be in square and should be set about 3 1-2 inches from the beam, touching the back stops. Some set the mule or carriage about one-eighth of an inch more out at the ends than at the middle; some set the ends one-eighth of an inch more in at the ends. So no hard and fast lines can be stated, only that when on coarse work the carriage runs faster than on fine work. I should state as a rule that coarse work should be set farther out at the ends than fine work. By watching this rule a spinner will find the benefit as regards broken ends. The scrolls on the back shaft should be in proper position with regard to one another.

Another point to consider is the drag compared with the twist. Say I was putting 21 turns per inch for 36 counts with a 62 drag gear and wanted to put 25 turns, I should put a 63 drag gear on, which would ease up the yarn. If I wanted to put less twist, say 18 turns for 36 counts, I should put a 61 drag gear on, or else I should find the yarn full of kinks or snarls. The idea of spinning is to get an even thread without straining it and without kinks or snarls. All channel rollers

nicked should be avoided or taken out. Drafts should not be all left to the middle and the front roller; the back and middle should do a share. The backing off friction should be set so that the threads will back off the spindles well and easily; the drawing up friction should be set not to slip, and if you cannot set have it recovered with a thicker leather.

The quadrant should be set right to wind the yarn on the spindles. The coppin rail and its connections should be set right to make a good cop. The weights should be enough on the levers to make a good hard cop. The easing motions or slides on the floor should be set in proper position. The cam shaft should be set in proper order. I consider the cam shaft the heart of a mule and other things must be taken into consideration. There are different classes of mules. There is the mule on the woolen system spinning cotton, mules built for coarse work, mules built for fine work, each having its different character.

Now I will write a few lines on ring spinning. Points requiring special attention are: The spindles must be free in the bearings, steady at high speed, and must be perpendicular, and in the centre of the rings. The rings must be round, hard, smooth and must be adjustable upon the ring rail so as to be concentered with the spindles, as the durability of the rings and travelers depends largely upon it. The ring rail must be level and travel in a perpendicular line so that the spindles will be in the centre of the ring the whole of the lift. If not good, rings are speedily made into bad ones, travelers wear out faster and the threads break down more often. The coppin motion and its connections with the ring rail must be set so that the ring rail will travel smoothly so that there will be no liability to jerk, slip or dwell. The thread guides must be set exactly over the centre of the spindles so that the yarn in its descent to the traveler will form a perfect one above the top of the bobbin. The winding on and drag are done by means of a small piece of steel bent in a circular form, commonly called travelers. These travelers guide the threads upon the bobbins like the fuller wire on a mule or the flyer leg in a throstle frame. Now there are different weights of travelers made to suit various cottons and different counts of yarn, that is, the finer and softer the yarn the lighter the travelers must be. But no hard and fast lines can be set. For the best work I will state a rule which will be found very useful.

| Counts of travelers. | Counts of yarn. |
|---|---|
| 10 | 10 |
| 14 | 7 |
| 20 | 2 |
| 24 | 1.0 |
| 32 | 4.0 |

and so on in proportion. But no hard and fast lines can be set. Rings, diameter, lifts or ring, rail, its length, must be taken into consideration as well as different classes of cotton.

## COTTON SPINNING.

### ESSAY NO. 101.

Without going too far into detail, so as to save space, I will confine myself to as few words as possible.

An overseer of spinning must needs be a slaver from the 6 o'clock whistle in the morning until it blows for rest in the afternoon, and there is much good argument here to show that he must be more of a slaver than any other overseer, principally because he has all-day laborers, whose pay goes on whether their machines are going or not, and most of his help being children, and naturally negligent, they do not see any profit to themselves from pushing their machines to their fullest capacity. Consequently, the "spinner" with his assistants has to keep things pushing, which later means production, which is second only to quality in the successful management of any department of a cotton mill. The third consideration is the cost, which is always governed mostly by the production.

So we will take, as our first consideration, quality. First, see that your carder gives you roving of good quality, clear of lumps and thin places, with just enough twist to pull the bobbin when in the creel without giving trouble from breaking. Set the nips of your rolls (front and middle) slightly greater than the length of your longest staple. In running 1 1-8 inches to 1 1-4 inches or more staple, jam your rolls up close and take all the weight off your middle rolls. You will find this especially advantageous in running uneven staple. Keep all excessive waste off top and bottom rolls, also from under spindle whorls.

I prefer a good hard roving band put on by looping the raveled end through the loop. Have the loop always pull the knot. If you put this knot on correctly you will not have soft yarn. I will gladly send a sample of my knot to any address on request, which is the best of many tried.

Keep your levers off the back guides at all times and teach your spinners the advantage to them in keeping all leather rolls in first-class shape. Save every roll possible but do not run a bad one; it is not economy. Do not allow your section men to fix "broken back ends" too freely with new rolls; see that each man has a spindle set and have him use it, as any spindle or ring is liable to get out of centre. It is useless for me to go into the details of centering top and bottom, also centering guide wires; these and many other points we cannot touch here are supposed to be known by every one from oiler up. I set my spool guides so that a knot used in the yarn will not quite pass through, remembering that a knot is quite as bad as a gant of the same size, and when you take a gant out you must put in a knot to save trouble in after processes. You can save much trouble here by keeping gants or lumps out on spinning. Preventives are better than cures here.

Do not allow your spindles to run dry. Use plenty of light gravity oil, with a paraffin base, as it will not gum. Don't allow your levers to get sagged and lay on creel board to keep them level. Don't allow tops of creels to be fanned off or guide boards to be fanned or blown out, as the flying lint will catch in the ends and cause gants. Don't allow "fan rags" in your room. Don't allow spindles to stand for anything; let your men know you are something yourself. Don't give your help too many privileges, but deal with them fairly and firmly.

Have a good system of doffing and keep them up to the highest possible standard, and keep enough of them to allow some rest, as a boy cannot stand doffing all day without some rest.

Everything needs a head. If you are overseer of a room you are its head; if you are a superintendent of a mill you are its head, and as you have a head, use it for the good of your employer. Keep plenty of supplies to keep up your machinery; try to keep an extra part of everything breakable. It is poor economy to let a frame stand while a four-dollar gear is being expressed from the shops or cast in a local foundry, which latter is very often rubbish.

# COTTON CARDING AND PREPARATORY PROCESSES.

### ESSAY NO. 102.

The mechanical treatment of cotton up to the finished roving, after ginning and baling, is done in the cotton mill. The first process is the mixing of the cotton in order to get a uniform quality and color. In order to do this it is best to lay down a mixing of cotton as large as means will permit. Where different kinds of cotton are mixed together the greatest care should be exercised in the selection of the length of cotton or fibre so it will be of one length. If short and long staples are put together there will be excessive waste and poor yarn. After mixing, the next process is willowing or opening. There are different kinds and makes of machines, but I am not going to write upon the merits of any machine. There is the Oldham willow, which is chiefly for opening dirty cotton and cleaning cotton waste; Crighton's, Lord's, cone cylinder, porcupine and beater. When a carder goes to a mill he has to make the best of the machines in the mill; he cannot use just what he fancies. Cotton, besides being matted together, contains impurities, such as sand, leaf, dust, seed, shells, etc. The process of opening is to loosen up the fibres of cotton and the impurities drop out.

Next is scutching, which has a twofold object, the further extraction of impurities and the formation of a lap which is a sheet of cotton wound around a small roller. In this the fibres lie in all directions. Well-made laps should be even in the sheet, level at the edges, uniform in length and weight. Any differences from these points are defects likely to affect the final results. The chief point to be regarded is the method of feeding the machine. There are two plans in use, the one being hand feeding and the other mechanical. When fed by hand the cotton must be carefully and evenly spread over a measured place of the traveling creeper. Unless this is done the results will be bad. It is important that a trustworthy person be placed in charge, but the other method being mechanical has been devised and invented to overcome the difficulties. Experience has shown this to be best, and it is called a hopper feed motion. Most persons consider this latter the best. Laps should be as even as possible. The method usually adopted to make them so is to weigh the laps as they

come from the machines and classify them for the finisher lap machine, in which three, four or six laps are combined as feed material from which the last or finished laps are made. By this combination or doubling the irregularities are overcome, the last lap being perfect as far as possible.

Next is carding; the process of opening is continued, but the cotton is treated in its individual fibres and laid in a parallel order that is afterward condensed into a sliver or round, soft and untwisted length of cotton. Where changes are made in the counts lower, there will be a demand made upon the cards for a greater production. This condition requires great care from the carder.

Light carding is easy enough, but heavy carding requires the closest attention in order to prevent the cotton from being delivered before it is properly carded. In relation to good carding grinding is an important duty. There are different kinds of cards, such as the roller and clearer cards, Wellman flat cards, which differ from the ordinary flat cards in that each has a different character. An even temperature should be kept in each room as nearly as possible and dampness and dryness especially be avoided, as the former causes the laps and rollers to lick, causing waste, while dryness of the atmosphere causes the fibres to curl and fly off, owing to the friction of the fibres against one another developing a certain amount of electricity. Combing is used for the production of fine yarns or those of high quality, its object being to obtain uniformity in the length of staple cotton used.

In the operation of drawing several slivers from the carding are combined to the size of one, say six slivers made into one would require a draft of six, the object being to make the new sliver more uniform in thickness and to place the fibres more in parallel order.

Slubbing is a further combination of slivers and the objects of drawing are more perfectly accomplished. But here it becomes necessary to twist it slightly, in order to preserve its rounded form and to bear the strain of drawing it from the bobbin without pulling uneven places. Intermediate slubbing is a repetition of the above, but it is not ordinarily used except in very fine counts. Roving is a continuation, its principal object being to make a smaller sliver, and it should receive additional twist to bear the strain of drawing from the bobbin. Another thing called the jack frame is mostly used for fine numbers. The quality and numbers of the yarn it is intended

to make having been decided upon, the next question is how the best drafts for hank roving can be obtained. I wish to write here that slubbing, intermediate, jack or roving frame are all constructed and worked on one principle, the only difference is that each one makes a finer hank than the preceding one.

To find the hank at any process multiply the hank at the machine from which your calculation is to begin by the sum of the draughts up to the one whose hank you seek, and divide by the sum of the doublings.

# THE TEXTILE FIELD.

[By E. Howard Bennett, of the "American Wool and Cotton Reporter" in "Printers' Ink."]

It is a fact, as shown by the census reports, that the textiles are produced by the largest manufacturing industry in the United States. Yet in any given line of machinery or mill supplies, so far as the textile field is concerned, one or a few houses monopolize the trade from textile mills. This is because the manufacturers in these lines are ignorant of conditions in the textile industry.

Here is a pertinent illustration: A certain chemical is used both by textile manufacturers and by tanners. Three concerns, A, B and C, in the United States make this chemical. A had all of the textile trade and sold the compound to textile mills for 16 cents a pound. A, B and C sold exactly the same thing to tanners for 14 cents a pound. B and C, after several years (it seems strange but it is true), discovered how A was disposing of the bulk of his product, and they both went after the textile trade.

## FALSE IMPRESSIONS.

There are reasons why manufacturers of supplies who ought to be doing millions of dollars' worth of business every year with textile manufacturers are ignorant of their opportunities in this direction. Every tailor and clothier in the United States advertises imported cloth, and we believe with him that every piece of goods in his shop is imported, i. e., we believe that the bulk of the cloths we see are the product of English looms. Again we hear that England supplies the world with textiles and we believe it; further, we read of the immense exports of raw cotton, and finally, the textile manufacturers have been so secretive that we in previous years heard little of them.

All of these things combined have had a tendency to make us all believe that while as a nation we were pretty smart in iron and steel we didn't amount to much as textile manufacturers. That all this is wrong is shown by the fact

that one textile mill—one of nearly fifty in a textile town—is shipping every hour of the day about 80 miles of cloth.

### A CASE IN POINT.

Here is an example proving ignorance of opportunity on the part of those who could advertise to the textile manufacturers profitably. In Boston an engineering concern makes a specialty of power plant development. I tried to interest them in the textile field. They would not interest worth a cent because they said the individual plants were not large enough.

"Why," they said, "do you know that one of the power plants we developed out in Butte, Montana, runs all of the mines there and uses 60,000-horse power?"

I left that office hurriedly and returned in ten minutes with an engineer's statistics of one textile mill (the executive offices of which are in Boston and within two minutes' walk of the office in question) which showed a utilized horse power of about 80,000.

### STRIKING FIGURES.

Consider the State of Rhode Island, the most densely populated state in the Union. It is all textile manufacturing. From the time you enter the state at the Connecticut line until you leave it to go into Massachusetts, you are never out of sight of a textile mill.

One of these mills, J. & P. Coats, has a surplus of $35,000,000 and monopolizes the spool cotton business of the world; another, the Solway Dyeing & Textile Company, makes the highest priced cotton cloth in any market. Some employ a few operatives and utilize local electric power; others, like the great mills of the American Woolen Company, employ in several mills 5,000 operatives per mill and use immense amounts of practically every chemical and all kinds of mill supplies made in the United States or imported from any quarter of the globe. They operate 30 mills.

Take the two Carolinas. In those two Southern States cotton manufacturing has been carried on only about a dozen years. Now there are about 700 mills employing about 100,000 operatives.

### GOODS USED BY MILLS.

In one good-sized town in New Jersey every building in the town, with the exception of three houses, is owned by

the textile corporation there located. Can you think of a better opportunity for the sale of paint, plumbing supplies, roofing, etc.? In a certain textile town 30,000 operatives live in houses—good houses, too—all owned by the mill corporations. It would almost pay to advertise interior finish to those textile mill owners.

One textile mill develops 17,000-horse power, uses 90,000 tons of coal per annum, 600,000 pounds of starch, 47,000 gallons of oil. Ships sail up to its docks and freight trains run into its storehouse. This mill operates 13,000 looms and 500,000 spindles. It does not depend upon the builders of textile machinery for spare parts, for it would be ruinous to have to wait a minute for them, so it has a machine shop of its own. I don't remember about the equipment of that machine shop, although I do know that they used in the mill yard an 18-horse power automobile truck. The engine was not large enough, so in their own shop they built a 40-horse power engine. Wouldn't this mill be a good prospect for the sale of boilers, of which they have 97; engines, of which they have a dozen; motors and generators, of which they have many; feed-water heaters, pumps and every kind of steam appliances, machine tools, etc.?

## REPLIES TO THE SKEPTICAL.

I have run across many manufacturers who claim that they can't sell to textile mills. Here are some examples of such:

1st. A concern in the middle West, selling a vertical boiler, opened a Boston office, tried a while to sell, and then quit. But at the same time I can name, off-hand, two mills which use vertical boilers—the Indian Orchard Company and the Naumkeag Steam Cotton Company—and there are several others. The textile mills will buy vertical boilers if they are right.

2d. A concern with a wool washing compound couldn't sell it, saying the fault was graft. It wasn't. A fair trial was given the new compound, and it cost $90 to wash 20,000 pounds of wool. The old process of washing with potash soap cost $42 to do the same work. You can't sell the textile trade gold bricks.

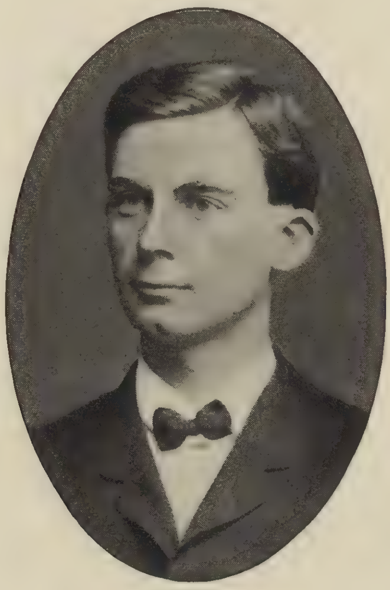
3d. Another concern says that textile mills use "cheap" stuff, so they can't sell them. Textile mills don't buy junk; they buy as high-class goods as Robert Wetherill engines and boilers and McIntosh Seymour engines.

4th. Someone says that textile mills don't purchase beyond the absolute necessities. One mill spent $250,000 for an escalator, or moving stairway, to make it easy for their operatives to reach their stations; another spent $45,000 for ten automobile trucks to move cotton from storehouse to mill; many mills have spent tens of thousands of dollars for swimming tanks, gymnasiums and club houses for their operatives. Others maintain schools and hospitals, kindergartens and day nurseries.

## THE TEXTILE TERRITORY.

New England, New York, Pennsylvania, North Carolina, South Carolina and Georgia comprise the textile states. There are mills in Virginia and West Virginia, Ohio and a few in other states, but take the first grouping and that is the bulk of the industry. There are 6,000 of these mills.

# BIOGRAPHICAL SKETCHES OF SOME OF THE PRIZE WINNERS.



WILLIAM M. McCARD.

[Winner of Fourth Prize in Processes of Knitting.]

Was born in Philadelphia in 1883. He received a public school education and started into work in the Wm. Vernon Hosiery Mill at the age of thirteen years. Stocking turning was his first work and from this he worked his way to the top and showed his employer that he could do things, and to-day he enjoys the prosperity that the hosiery business affords any ambitious, sober and industrious man.

RODGER GRAHAM.

[Winner of Second Prize in Cotton Spinning.]

Was born in the year 1865 in Rawtenstall, Lancashire. When eight years old, he obtained employment as a doffer in the ring room of Hardman Brothers, Rawtenstall. Afterwards he went as a back boy on mules and rose up to be an operator and then to second hand. He went to Newchurch, spinning and weaving, West Cloughfold, North Manchester, and was with them about twelve years. He came to the United States in the year 1906 and worked for the Atlantic Mills, Lawrence, Mass. Afterwards he went as second hand of spinning to Salmon Falls, N. H. He has been with them three and one-half years. He attended the night schools on textiles and passed through the first class, ordinary, at the London City Guilds, on cotton spinning and carding. Afterwards he gained the first class honors at the London City Guilds on the same subject; also first class in Lancashire and Cheshire machine and cotton calculations, the highest certificates obtainable on those subjects in England.

Mr. Graham is married, has four children, one son working as a mule spinner and another, a girl, working as a weaver.

W. H. COCKCROFT.

[Winner of First Prize in Worsted Combing.]

Was born in Bradford, England, July 28, 1869, and came to Canada with his parents when a boy. He began his mill life at the mills of the Ontario Worsted Company, Elora, Ont., a concern now out of business.

In 1886 he accompanied his father to Almonte, Ont., when he took charge of the worsted spinning plant of the Rosamond Woolen Company, and acted as assistant for six years, thus gaining a thorough knowledge of all branches of the worsted business from the wool to the finished yarn.

In 1892, when his father resigned, the firm appointed him to the vacant position which he held for upwards of fourteen years, during which time the amount of machinery under his charge was doubled and the variety of the work very much extended.

In 1906, after nearly twenty-one years of service with this company, he resigned his situation and came to this country, believing there was a better chance for a man of his business ability over here. After a few months in Providence, he

obtained a position with the Geo. H. Gilbert Manufacturing Company, of Gilbertville, Mass., remaining there until fifteen months ago, when he took charge of the worsted spinning plant of the Wuskanut Mills, at Farnumsville, Mass., owned by S. Slater & Sons, Inc., of Webster, Mass., which position he still holds.

From his long experience he has acquired a thorough knowledge of the theory and practice of manufacturing worsted yarns from all grades of stock.

MATTHEW ALLEN.

[Winner of Second Prize in Woolen Spinning.]

Was born in Dumfies, Scotland. He went to work in the spinning room at fourteen years of age, served five years' apprenticeship in woolen spinning with the firm of Dickson & Laings, of Harwick, Scotland. He came to America in 1888, went to work in the spinning room of L. W. Faulkner & Son, of Lowell, Mass. After spinning for a short time he was promoted to second hand. He remained there for three years, leaving to become overseer with the Cheshire

Mills, of Harrisville, N. H. He remained there for one year. He resigned to accept a position with D. R. Campbell & Son, of Sangerville, Me. He remained with them two years. He resigned to accept a position with the Cochrane Carpet Company, of Malden, Mass., now of East Dedham, Mass. After working with this company for two and one-half years, he resigned to accept a position with the Georges River Mills, of Warren, Me. He remained with them over seven years, leaving there to accept a position with the Grand Forks Woolen Company, of Grand Forks, N. D., and was with them three years until the mill closed and they went out of business, when he returned to the East and accepted a position with the Globe Mills, of Utica, N. Y., as overseer. He resigned to accept the position of night overseer with the American Woolen Company, at Winooski, Vt., where he remained for three and one-half years, until the night work stopped. He then accepted a position with the American Felt Company, of Glenville, Conn., and after staying there a short time accepted a position with the A. D. Gleason Mill of Gleasondale, Mass., which he resigned to accept his present position with the Wyandotte Worsted Company, of Waterville, Me.

## F. I. HALL.

[Winner of First Prize in Cotton Spinning.]

Was born in Burlington, Vt., January 15, 1869. He received his education in the public schools of Burlington.

At the age of fourteen he entered the employ of the Burlington Cotton Mills, starting in the ring-spinning room, carrying bobbins from the spinning room to the spooling room. In a short time he was promoted to the position of doffer, where he tried the patience of his second hand by playing a great deal and doing just as small an amount of work as possible.

At the age of sixteen he changed from the ring-spinning room to the mule room, where he learned to run a pair of mules.

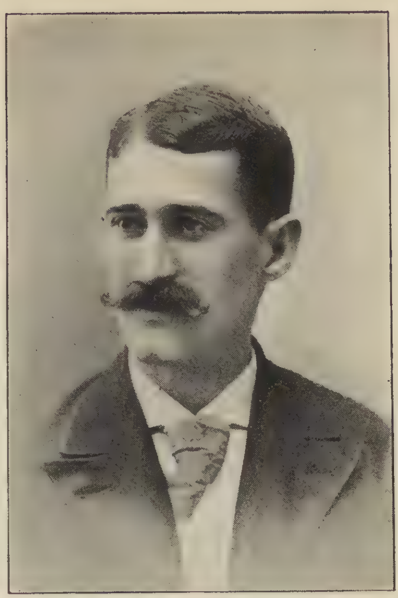
When Mr. Hall was eighteen, he married Miss May Duval, of Keeseville, New York, and to this important event he owes whatever success in life he has attained, for he very soon found if he was to give his wife a home he must earn more money than he was earning at mule spinning.

F. I. HALL.

As he could see but very little chance for advancement in Burlington, he went to Lowell, Mass., and started in the Boott Cotton Mills as mule spinner. In a short time he was advanced to section hand, and then to second hand in the ring-spinning room after being second hand for about a year, he was offered a position as head second hand in the Hamilton Manufacturing Company, of Lowell, Mass., having charge of 50,000 spindles, and where he stayed about seven years.

In the year 1900, Mr. Hall accepted the position of overseer of ring spinning in the Androscoggin Mills, at Lewiston, Me., under Geo. W. Bean, agent. Here he had charge of about 50,000 spindles running on numbers from 6s to 40s warp and filling. He stayed at the Androscoggin Mills about eight years, afterwards going to the Edwards Manufacturing Company's mill at Augusta, Me., as overseer of ring spinning, spooling, warping, dressing and web-drawing, which position he now holds.

Mr. Hall has one son, Leo Frederic, who is a member of the Senior class of the Bowdoin Medical School in Portland.



JOHN E. GILROY.

[Winner of Third Prize in Woolen Spinning.]

Was born in Westerly, R. I., December 22, 1866, and began work in the mill at the early age of nine years, working as a bobbin boy in the woolen mill at Mechanicsville, Conn., then operated by S. L. & T. I. Sayles, remaining there quite a few years, afterwards being employed in the S. L. Sayles Woolen Mill, at Dayville, Conn., as a spinner for a number of years. Later he was employed in the same capacity in mills situated at Glendale and Pascoag, R. I.

The year 1884 found him employed as a spinner in the Ray Woolen Company's mill at Franklin, Mass., where he remained ten years, terminating work there to assume his first situation as overseer in the employ of the Cowan Woolen Company, Lewiston, Me., where he stayed for four years. In 1898 he engaged with the Hillsboro, N. H., Woolen Mill Company, as overseer of spinning and is still with that concern. Starting from humble conditions in boyhood, Mr. Gilroy trod no flowery path to the attainments of those qualifications that go to make an efficient overseer. It was the hardest

kind of practical experience and persistent effort that brought him to the top. Mr. Gilroy is married, owns his home, has two daughters, one a student at Mt. St. Mary's Seminary, Hookset, N. H., the other is an attendant at the high school in the town where he resides. He is of steady, reliable habits and a model citizen. Mr. Gilroy may well be classed among the best of woolen mill overseers.

WILLIAM F. RAWLEY.

[Winner of Third Prize in Woolen and Worsted Weaving.]

Was born in Glendale, R. I., January 10, 1878. He was the son of Thomas Rawley, for many years mill superintendent, and at one time a stockholder of a mill at Staffordville, Conn. He entered the woolen mill when quite young. His first position was that of a spooler tender at the Elm Mills, Tilton, N. H. From that mill he went into the card room at the Tilton Mills in the same town. He worked there about one year. From there his parents moved to Somerville, Conn. Then he entered the weave room of the Keeney Manufacturing Company, and worked there two years,

his father being the superintendent. From there he went to superintend the mill of the Jefferson, Mass., Manufacturing Company. There he entered the finishing room where he worked several years. From there he went to East Glastonbury, Conn., where he again entered the weave room for the Crosby Manufacturing Company. From there he went to Rockville, Conn., and was employed in the New England mill. After that he entered the employ of the Putnam, (Conn.) Woolen Company, first as a weaver, then dresser and after that employed in the designing room. He worked here for seven years. On December 12, 1901, he married Lillian Edith Brown, a popular young lady of Danielson, Conn. Since that time he has been blessed with three children, two boys and one girl.

After he left Putnam he hired out as overseer of dressing for the Brigham Woolen Company, then located at Elmville, Danielson, Conn. He stayed with this company two and one-half years, and then hired out as designer and assistant superintendent for the Avon Woolen Mills at Wales, Mass. He worked there about six months and then re-entered the Brigham Woolen Company's plant again as overseer of dressing, but when this mill stopped running, he went back to be designer and assistant superintendent for the Avon Company at Wales. When he finished his duties there he hired out as overseer of dressing for the River Tree Worsted Company. After a short while he had charge of both the weaving and dressing departments. He stayed there until the company was forced to vacate, and later the company removed to Medway, Mass. He did not go with them as he had a good offer to remain and take charge of dressing for the new company, the Thistle Worsted Company, which position he filled for a period of six months. From there he went to Monson, Mass. He entered the employ of the Somerset Woolen Company. From there entered the employ of the Rhode Island Worsted Company, Stafford Springs, Conn., where he is engaged at the present time.

NORMAN HIRST.

[Winner of Fourth Prize in Woolen and Worsted Weaving.]

Was born in Huddersfield, Yorkshire, England. He began work at the age of ten years, being employed as a piecer in the spinning department of a woolen mill in this capacity for eight years. From that he went to the weaving department, being employed as chain builder, weaver and loom fixer. He came to America nine years ago. He has served in various positions in the weave room, especially as loom fixer.

L. G. DRUMMOND.

[Winner of First Prize in Woolen and Worsted Finishing.]

Is thirty-three years of age. He first worked at woolen finishing in the Buena Vista Cassimere Mills at Buena Vista, Va., when fourteen years old, working first as gig boy and last as second hand, which covered a period of nine years. Upon leaving the Buena Vista Mills he accepted a similar position with the Monogahela Textile Company at Morgantown, W. Va., which position he resigned to accept a position as wet finisher for the Virginia Woolen Company at Winchester, Va., July 8, 1901. Sometime later he was put in charge of both wet and dry finishing. In March, 1907, he passed a civil service examination and was appointed United States textile inspector in the quarter-master's department at New York City. Not being satisfied away from the buzz and rumble of the mill, he resigned and accepted his former position as finisher for the Virginia Woolen Company, which position he is at present successfully filling.

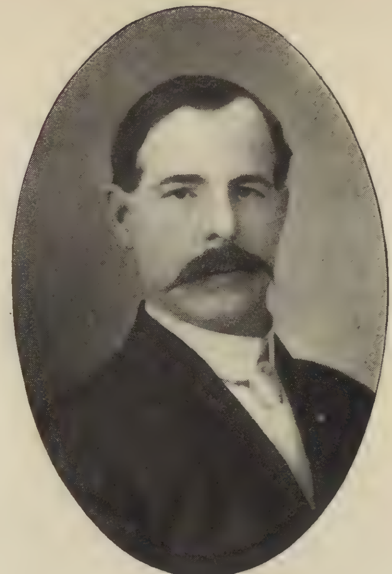
JOSEPH H. RIDINGS.

[Winner of Second Prize in Woolen and Worsted Finishing.]

Was born in Heywood, England, and at the age of two years came to this country with his parents. He first began work in the card for the Concord Manufacturing Company, where he worked for a short time in the spinning room, after which he worked up to second hand in the finishing department.

His first position as overseer of the finishing was with the Hudson River Woolen Mills, Newburgh, N. Y. He has had charge of finishing for the following mills: Burlington Woolen Mills, American Woolen Company of Winooski, Vt.; Plainfield Woolen Company of Central Village, Conn.; Tremont Worsted Company, Methuen, Mass. He was also superintendent of the dyeing and finishing plant of the Jersey Cloth Company of Methuen, Mass. At present he is the finisher for the Geneva Woolen and Worsted Mills of the Wanskuck Company of Providence, R. I.

He is a member of the National Association of Woolen and Worsted Overseers.



JAMES A. TAYLOR.

[Winner of Third Prize in Woolen and Worsted Finishing.]

Was born in Leeds, Yorkshire, England, and served his apprenticeship in finishing with Asquith Brothers, dyers and finishers, under his father, who was boss finisher thirty years. Came to the city of Philadelphia in May, 1892, in the midst of a panic, and had to work his own way up as he had no influence. He secured his first position with the Firth & Foster Finishing Works doing night work. He left and took charge of the finishing at the Pennsylvania Woolen & Worsted Mills. He remained there three years until the mill shut down in 1906. He then took a position with the Southwark Mills Company, all of Philadelphia. Then he went to start up the finishing at the Amsterdam Woolen Company, Amsterdam, N. Y., and later at the Consolidated Woolen Felt Mills, where he remained three years. He also started up the Nelson-Dedicke Felt Mills, Middleville, N. Y., and Alfred Dolge Manufacturing Company, Dolgeville, Cal. He returned East on account of the death of his mother and accepted

a position at the Martinsburg Worsted & Cassimere Company, Martinsburg, W. Va. He remained one year there and resigned and took full charge of the finishing with the well-known firm of E. T. Steele & Company, Bristol, Pa., with whom he stayed two years. Then he went back to the Martinsburg Worsted & Cassimere Company, Martinsburg, W. Va., where he at present holds the position of overseer of finishing. He has been here four years.

J. C. EDWARDS.

[Winner of Third Prize in Cotton Spinning.]

Started his textile career at the old Oates Mills, Charlotte, N. C., at the age of eight, when that was the only cotton manufactory of Charlotte. After serving four years in the several mills that Charlotte started from 1889 to 1893, and having had his salary raised from 10 cents to 35 cents per day, he felt sufficiently independent to make his own way in the world, so with his father's consent and 75 cents, he arrived at Pelzer, S. C., where he was raised to the position

of oiler at 60 cents per day after about two years' service. After several years' service at Clifton and Newberry, S. C., he resigned his section in '99 to enter school at Andersonville, Tenn., where he remained for two years, entering the mill again in 1902, at Gaffney, S. C.

In 1904, after three years at Gaffney, S. C., Newberry, S. C., and Newholland, Ga., he was promoted to the position of overseer of twisting at the Anchor Duck Mills, Rome, Ga. In 1905, he resigned that position to re-enter the services of the Pocolette Manufacturing Company as spinner of their Gainsville (Ga.) Cotton Mills, which position he held until 1907, when he started spinning, twisting, etc., at the Tallapoosa (Ga.) Cotton Mills, re-entering the services of the Anchor Duck Mills in 1908 as overseer of spinning.

SYDNEY S. SALISBURY.

[Winner of Fourth Prize in Cotton Spinning.]

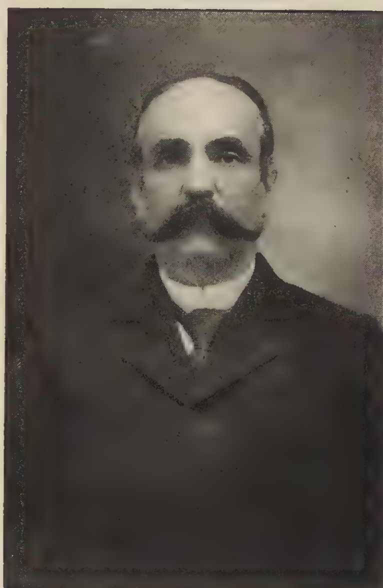
Was born in South Scituate, R. I., June 16, 1872. He entered the Quidnick Mill in the year 1884 and since that time he has worked in various mills in Rhode Island. He

enrolled in the International Correspondence School in the year 1902 and, taking the carding and spinning course, graduated in the fall of 1906. He entered the employment of the Rockman Manufacturing Company at Shady Lea Mill, in the year 1892. In April, 1905, he took charge of the spinning department, which position he now holds.

C. C. HARRIS.

[Winner of First Prize in Woolen Spinning.]

Began his first work as overseer for the Ashaway Woolen Mills Company, Ashaway, R. I., for which company he worked for about ten years. There he worked about ten years. Then he went to the American Woolen Company, Kennebec Mills, Fairfield, Me. From there he went to the Saxton's River Woolen Mills, Saxton's River, Vt. From there he went to the Assawaga Woolen Mills, Dayville, Conn., where he is at present working, having been there for the past two and a half years.



JOHN L. SHERWOOD.

[Winner of Second Prize in Wool Carding.]

Was born in Salisbury, Conn. He went to work in the Warhorse Woolen Mills at the age of nine years. He worked there until the mill was burnt down and at that time had charge of carding and spinning. After the fire he went to work at Fort Ann, N. Y., and took charge of carding. He went from there to Poughkeepsie, N. Y., for Titus & Sons, from there to Norwich, Conn., where he put up eight sets of cards for Hall Brothers, and stayed with them eleven and one-half years as carder; in Mohawk three years; with Davis & Furber two years, setting up cards; in Plainville three years, running eleven sets of cards and four garnets and picking room, and other places in Connecticut and New York State and New Hampshire.

A. B. HANSCOM.

[Winner of Fourth Prize in Wool Carding.]

Commenced working in the mill when quite young, first running a hand jack, then a mule, then stripping cards. From this he gradually worked up until he became overseer of both carding and spinning. Along in the eighties he went to work for the Davis & Furber Company, setting up and starting their cards and mules. He was with them twenty years. This work he did in different mills in the United States and Canada. It gave him a great opportunity to compare his work with other men's.

When he went to work in the mill again he had a chance to try those things which he had learned, and got the real value of them.

LEONARD W. MAINE.

[Winner of Fourth Prize in Woolen Spinning.]

Started as wool spinner at the age of fourteen at the Ashaway Woolen Company, Clark's Falls, Conn. He worked as spinner at several different places in southern Rhode Island and Connecticut. He started to work for the Pawcatuck Woolen Company, of Westerly, when first formed. He worked there as spinner, second hand and night overseer for about five years. He resigned and accepted a position as second hand in the Oneco Woolen Mills, New Bedford, Mass. He was there one year and a half. While there he went to the textile school and took a course in yarn mill arithmetic. He passed with a record of 93 per cent. He accepted a position as overseer of spinning at the Murdock Woolen Company, where he is at the present time.

W. SMITH.

[Winner of Fourth Prize in Cotton Carding and Preparatory Processes.]

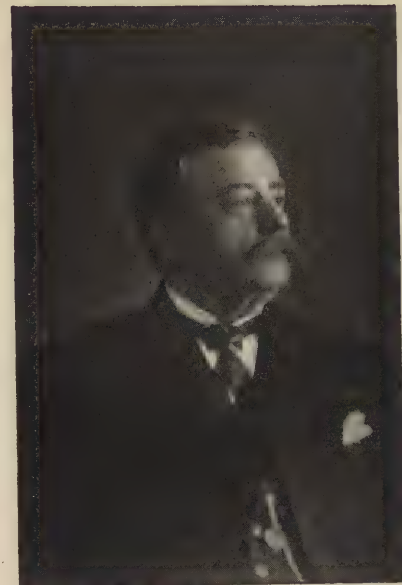
Was born in Yorkshire, England, on October 31, 1879. He started going to school at the age of five years. When he was eight years old, his family moved to Rochdale Lanes. He went to school there until he was ten years old. He then started work in the spinning room as a doffer. When he was thirteen, he started as a full timer in the mill and worked his way up to head doffer. Seeing no chance of advancement, he left the spinning room and went to work as back boy in the mule room. He was put to work on a pair of Taylor & Lang's mules, with a spindle gauge of 2 1-4 inches, spinning No. 4s filling. That was a pretty hard job, but he stuck at it until he was promoted to big piecer at the age of sixteen. He kept on working for the same firm and going to the technical school nights, where he gained his knowledge of calculations besides having machinery there from which to get the practice of fixing. At the age of eighteen, the spinner he was piecing for was promoted

to an overseer's job in another town, and the manager said Mr. Smith was rather young to run a pair of mules, but he said he would give him a trial as he had been working for him since the age of ten years. He ran that same old pair of mules that he had once been back boy on until he was twenty-two years old. He thought it was time to strike out for a better job, so he applied for a job as overseer on four pairs of old Walker & Hacking Mules in a small mill in Burry Lanes. He got the job all right and worked for that firm until they threw out the mules, which also threw him out of a job. He stayed round home for about six months, helping to put in new mules and start them up until a friend of his advised him to come to Canada. He left England in December, 1903, and started to work as mule spinner for the Canadian Colored Cotton Company at Milltown, N. B. He worked there for eleven months and the overseer he worked for got another job in the States. He thought jobs vacant in the mule room, so he went in and learned to weave on the Draper looms. He worked there as weaver for eleven months and then hearing of a fixer's job being vacant in the mule room of the Cabot Manufacturing Company, Brunswick, Me., he secured the job and started with them on July 5, 1905. After about eighteen months of fixing he was promoted to the second hand's position, which he held up until the last week of last October. He is still living in Brunswick.

THOMAS F. JOHNSON.

[Winner of Second Prize of Worsted Carding.]

Is the son of Patrick Johnson, who arrived in this country as a hand comber in the year 1866 and went to work in the Hamilton Mills, Lowell, Mass. Thomas began his career as a boy in the Ladenburg Mill at the age of eight years. In 1870 his parents moved to Haysville, Upper Darby. Mr. Johnson worked himself through the combing, drawing, spinning and twisting departments, also learning the machinist trade thoroughly. Leaving here he went to Montgomery, Orange County, to work, at which place he was married. In 1890 he left Montgomery, Orange County. to take charge of the combing at Twenty-first and Washington avenue under John Abizzeto. Leaving here he went to Crofts Mill in Camden, N. J., at which place he worked for nine years as boss comber and mixer of all the important colors sold during those years. Leaving Croft's he went to James Doak, Jr. & Company, as combing boss, serving under this position for four years, finally taking charge as superintendent of the whole place, where he is at the present time.



GEORGE F. MAGUIRE.

[Winner of First Prize on Wool Carding.]

Was born in Wilmington, Delaware, March 30, 1850.

His first knowledge of textile work was acquired when but eight years old in a cotton factory situated in Harrisville, R. I., in which he remained working two months. He then obtained employment in the carding room of a woolen mill, located in the same town, his duty being to weigh the wool and hand-feed it onto the aprons of first breaker machines. At this time he was so small that it was found necessary to build a platform for him to stand on in order to enable him to do his work.

Subsequently he worked upon every machine in the mill with the exception of the dressing machine, finally drifting back to the carding and spinning departments of the mill.

He served in Co. O, 3rd Batt., 16 U. S. I., during the latter part of the rebellion. After the close of the war he went to Johnstown, Pa., and assisted his brother James to set up the machinery in the Woodvale Woolen Mills.

Returning to New England, he again resumed his old occu-

pation of carding and spinning, having made himself pro ficient in these particular phases of wool manipulation. He has worked in several well-known woolen mills in the capacity of foreman carder and spinner.

Mr. Maguire is the youngest of three brothers, and one sister, who are well known to the trade by their holding responsible positions in first-class mills. It is characteristic of his family to take to mill work as naturally as a duck takes to water.

Mr. Maguire was intensely interested in the aim and object of the Overseers Association and grasped every opportunity afforded him to promote its interest. He served the Association as vice-president prior to his being elected its presiding officer in 1887 and served his second term as its chief executive officer in 1888.

During his administration of it's affairs, the Association prospered to a marked degree, and he may well take a pardonable pride in the progress it attained under his efficient leadership.

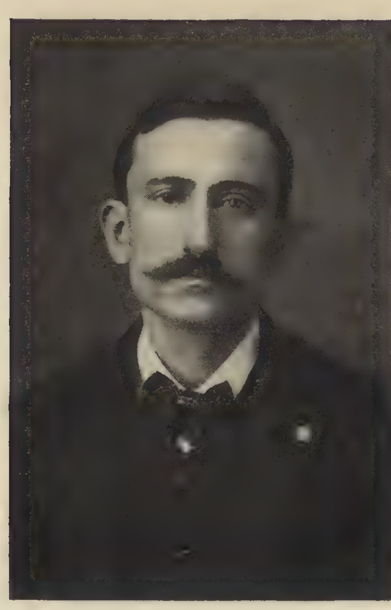
While in Johnstown, Pa., he married Miss Kate Murry, April 8, 1868, who came to Johnstown from Camden, N. J., to learn weaving and dressertending in the Woodvale Woolen Mills. Seven children were born to them, six boys and one girl, all of whom are still living, but Mrs. Maguire died at Wales, Mass., November 4, 1904.

Mr. Maguire is somewhat of a musician, having a fair command of the violin and brass instruments. He organized two bands, one, the Perry band, at Perry's, Mass., and the Wales Cornet Band, at Wales, Mass.; also a home orchestra, composed of himself and his own family, all of his children being musicians. One of his children is a carder, one a spinner, one a dresser, one a spooler twister, one a weaver and one a foreman in the Hoss Auto Manufacturing Company at Springfield, Ill. One of his sons is Dr. W. E. Maguire, dentist, now at Springfield, Mass.

JOSEPH HARRISON.

[Winner of First Prize on Worsted Spinning.]

Was born November 1, 1865, in a small village named Long Lee, in the Parish of Keighley, Yorkshire, England. At the age of eight years he started work as a half timer (that is, half day to school and half day to mill) in the mills of Messrs. J. & J. Craven & Company, Walk, Low & Dalton Mills, Keighley. When he was eighteen years old he had full charge of a room of drawing, spinning and twisting, ring, cop and fly spinning and twisting and made yarns from carpet stock to fine Australian. After working twenty-two years for Messrs. Craven, in 1895, he left Keighley and went to Bradford and started business on his own account as a commission spinner.



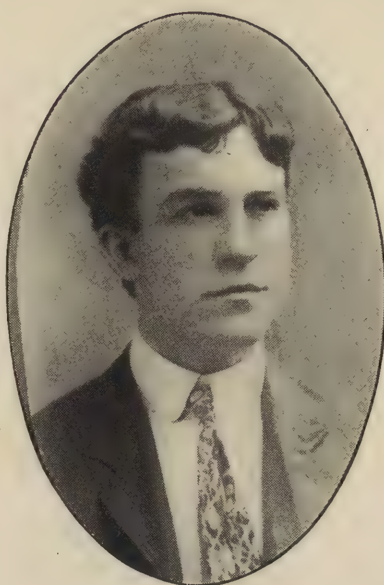
WILLIAM SHAW.

[Winner of First Prize in Cotton Carding, and Fourth Prize in Worsted Spinning.]

Was born in Fall River, Mass., in 1870 and attended the public schools until 1885, when he began work in the Merchants Mills, Fall River. In 1887 he was appointed second hand in Durfee Mill No. 1, and remained there until 1892, when he returned to the Merchants Mills as second hand, where he remained until 1894. He then started to line machinery in mills and continued until 1896 when he returned to the Durfee Mills and remained there until 1898, when he became second hand at the Border City Manufacturing Company's No. 2 Mill. At the end of eleven months he was promoted to overseer, and has remained with them ever since.

In 1901, he graduated in complete cotton course, and recently finished a course in complete steam engineering.

For ten years he has taught the boys in room five, Hudner Building, Wednesday and Saturday evenings. This he has done free of charge. However, he has been well rewarded, for at least twenty of his pupils are now overseers.

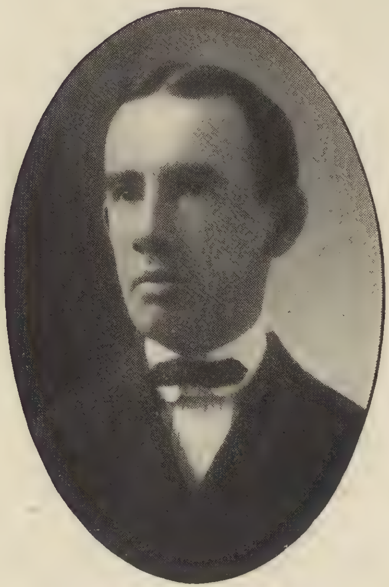


J. C. LOWREY.

[Winner of Second Prize in Processes of Knitting.]

Was born in Winchester, Va., May 23, 1878. He served six years with the Lewis Jones Knitting Co. at Winchester and then took a position with the Vassar Knitting Mill. He was with them ten years, until the mill closed. He then took a position with the Way Muffler Company, of Philadelphia, in charge of cutting.

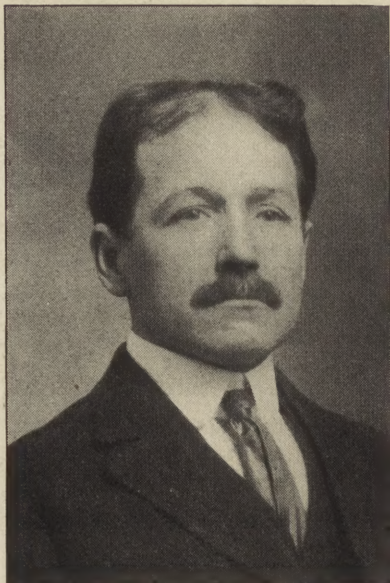
He started in business for himself last September as the Calvin Knitting Company. He has two patents granted him, one on the Lowrey Block Stitch; the other on Looes flare bottom pants and union suits.



WALTER P. BROWN.

[Winner of Third Prize in Processes of Knitting.]

Was born in the city of Lowell, Mass., on the 21st of December, 1879. Worked at the hosiery business for ten years as knitter, fixer and overseer. Now located in Philadelphia and employed by the Melbourne Hosiery Mills as fixer on seamless machines.



S. M. PETERSON.

[Winner of First Prize in Processes of Knitting.]

Was born in Sweden, 1870. Came to this country in 1887. Worked at various things for five years; had some money saved and took an eight months' course in business college and entered the employ of West Bros., of Syracuse, N. Y., as a bookkeeper. Was in this capacity a year, then took charge of finishing room for four years. Then went to Greenwich, N. Y., and worked there for about two years. Worked for The Lackawanna Mills of Scranton, Pa., six years, having charge of finishing room.

Worked for Grant of Trenton about one and one-half years. Had charge as superintendent of The Josephine Mills of Cedartown, Ga., also The Alpine Mills of Pittston, Pa., one year each.

At present has charge of finishing room with the Fort Schuyler Knitting Company, of Utica, N. Y.